

# **MONETARY AND FISCAL POLICY SPILLOVER AND COORDINATION IN THE SACU AREA**

Submitted in fulfilment of the requirements in respect of the Doctoral degree PhD in Economics in the Department of Economics and Finance in the Faculty of Economic and Management Sciences, Department of Economics at the University of the Free State

by

DUDUZILE NDLOVU

November 2020

Promoter: Prof. Philippe Burger (University of the Free State)

**DECLARATION**

I, Duduzile Ndlovu, declare that the thesis that I herewith submit for the Doctoral degree (PhD in Economics) at the University of the Free State, is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.

## **Abstract**

Interest in economic and monetary integration among groups of countries has been rising over the last three decades, with growing international interest emanating from the successful setup and launch of the EMU and the euro as the common currency of the EMU. Full monetary integration, the key focus of this study, entails setting up a regional central bank that is responsible for the formulation and implementation of monetary and exchange rate policies, having a single currency, as well as having formal regional surveillance of domestic economic (fiscal and structural) policies of the member countries. The Southern African Customs Union (SACU) incorporates an incomplete and asymmetric monetary union, the Common Monetary Area (CMA) and its journey towards the formation of a complete monetary union would involve preparatory stages of harmonising and linking macroeconomic and financial policies, institutions, and rules and regulations of the potential member countries. Therefore, this study explores whether or not there is an economic, monetary and fiscal policy case for the SACU region to become a fully-fledged monetary union by investigating the nature and degree of policy spillover effects and policy coordination across the region.

Through four articles, the study employed various econometric techniques, which include principal component analysis, Johansen cointegration techniques, Vector Error Correction modelling (VECM), Granger causality testing, Structural Vector Autoregressive (SVAR) modelling, the Diebold-Yilmaz (DY) spillover index, the Set-theoretic approach (STA), and policy reaction functions to address the objectives. The main contribution of the study is the conclusion about the structure of monetary and fiscal policy management to establish whether or not there is an economic, fiscal and monetary policy case for SACU countries to move towards full monetary integration, as embodied in a monetary union.

The major finding of the study is that, while monetary policy spillovers and the spillover effects seen through testing the South African dominance hypothesis make a case for monetary integration and a monetary union, the lack of coordination between fiscal and monetary policy means that fiscal and monetary policy coordination first needs to improve before a move can be made to monetary integration and union.

This is particularly important if we see the threat that the lack of such coordination in the euro area made towards the existence of the euro area.

*Keywords:* SACU countries, monetary policy spillovers, fiscal policy spillovers, monetary and fiscal policy coordination, financial development spillovers, VECM, set-theoretic approach, policy reaction functions

## DEDICATION

The thesis is dedicated to the Lord Almighty, my husband, Sindiso Ndlovu, my son, Khanya Ndlovu and my parents, Drs P. and S. Moyo and Mr and Mrs C. Ndlovu.

## **ACKNOWLEDGEMENTS**

I owe the success in completing this thesis to various people. Firstly, I give thanks to the Lord Almighty, for giving me the knowledge, wisdom, and strength to see this study through. I greatly acknowledge my supervisor, Prof. Philippe Burger, who believed in me and encouraged me through his meticulous guidance and supervision. He encouraged and supported me throughout the study and that made the journey bearable and a bit easier. I particularly appreciate his patience and commitment towards the project as well as the time he spent reading and discussing the thesis with me.

My beloved husband, Sindiso, also played an immeasurable role in the success of this study. He witnessed all my hard work and pain during the study and made sacrifices necessary for the completion of my study. I will forever be grateful for all the love, support and encouragement he gave me throughout the period of the study. I am truly grateful to my loving parents, parents in law and sisters for their encouragement. They always told me what I needed to hear at the right time and that helped me get to the end of this PhD journey.

A special mention goes to Dr Sevias Guvuriro, Corrie Geldenhuys, Prof Hendri Kroukamp, Mr J.P. Geldenhuys, Miss Awongiwe Nkata, my colleagues at the Department of Economics and Finance at UFS and Prof L. Lues for their respective support towards the completion of my PhD study, especially towards the end of the study. I am not able to mention each and every person who supported me through this journey but I thank you all.

Last, but not least, I acknowledge the UFS Postgraduate school and the Department of Economics and Finance for funding some of the software used for my study and providing me with the opportunity to attend a national conference, where I received valuable feedback to incorporate into the study.

The thesis also greatly benefited from comments by participants at the *The Biennial Conference of the Economic Society of South Africa (ESSA)*, 3-5 September 2019, Johannesburg, South Africa where a paper on a section of the thesis was presented.

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## **INTRODUCTION**

### **1. BACKGROUND AND MOTIVATION**

A notable feature of the last three decades is heightened economic and monetary integration among groups of countries, mostly in the same region. Following the successful setup and launch of the European Monetary Union (EMU) and the euro as the common currency of the EMU, there has been growing international interest in economic and monetary integration, with countries around the world setting up several arrangements towards achieving a full monetary union in the region. Several African regional integration arrangements, such as SADC (Patroba and Nene, 2013), ECOWAS (Fwangkwal, 2014), and the CFA franc zone (McCarthy, 2012) aim to become full monetary unions, with complete monetary integration in their regions. Some of the SADC member countries (South Africa, Botswana, Lesotho, Namibia and Swaziland<sup>1</sup>, the latter four known as the BLNS countries) constitute the Southern African Customs Union (SACU), which is the focus of this study.

Monetary integration involves the harmonisation of policies among different countries, as well as the formation of a monetary union among countries (Fwangkwal, 2014). A monetary union is a piece in the puzzle of achieving regional integration in Africa and is an example of full monetary integration. According to Jefferis (2007), full monetary integration is one of the highest forms of integration. Essential features of full monetary integration or establishing a full monetary union include having a single currency in the region or a permanently fixed exchange rate of currencies that are fully convertible to one another, as well as assigning monetary policy instruments to a regional monetary authority with no countries determining their own monetary policies (Masson and Pattilo, 2002; McCarthy, 2012). These features imply that full monetary integration involves eliminating all exchange controls in the region and assigning monetary and exchange rate policies to a regional central bank. The anticipated process leading to a full monetary union comprises various stages, including macroeconomic and fiscal convergence, monetary integration and monetary union at regional level, with a single currency and central bank.

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<sup>1</sup> While writing this thesis Swaziland changed her name to Eswatini, but for consistency in this thesis Swaziland has been used.

The question this thesis seeks to address is whether or not an economic, monetary and fiscal policy case exists for the SACU region to become a fully-fledged monetary union.

### **1.1. The SACU members**

The SACU region is characterised by a highly integrated monetary system (Aziakpono, 2008). Though formally established in 1974, SACU is the longest-standing customs union in Africa, being informally in existence since 1910.<sup>2</sup> The primary goal of the SACU is to promote economic development through the regional coordination of trade. Some of the objectives of the SACU (Article 2 of the 2002 SACU Agreement) are to:

- facilitate the development of common policies and strategies among member countries,
- promote the integration of member countries into the global economy through enhanced trade and investment,
- promote conditions of fair competition in the Common Customs Area, and
- create effective, transparent and democratic institutions that will ensure equitable trade benefits to member countries.

After the establishment of the South African Reserve Bank in 1921, the South African pound (which became the South African rand in 1961<sup>3</sup>), became the only medium of exchange and legal tender in all the five SACU countries (Wang, Masha, Shirono and Harris, 2007). In 1974, the SACU countries formally established a currency union by signing the Rand Monetary Area (RMA) agreement. Nonetheless, to retain the capacity to formulate and execute its own monetary and exchange rate policies to stabilise its economy, Botswana exited from the RMA in 1975 (Wang *et al.*, 2007). Though remaining in the RMA, the other three, smaller SACU economies (Lesotho, Namibia and Swaziland) also eventually established their individual central banks, with Swaziland establishing its central bank in 1974, Lesotho in 1980, and Namibia in 1993.

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<sup>2</sup> An early version of the SACU dates back to 1889 where it entailed a convention between the British colony of the Cape of Good Hope and the Orange Free State Republic. However, in 1910 a new Agreement was signed which included South Africa, Botswana, Lesotho, Namibia and Swaziland. Namibia was a *de facto* member since it had been administered by South Africa following World War I, before it became a full member at a later stage.

<sup>3</sup> The rand was introduced on 14 February 1961, three months prior to South Africa becoming a republic.

In April 1986, the Common Monetary Area (CMA) of Lesotho, Swaziland and South Africa was established from the revised RMA, and Namibia joined in 1992. The CMA agreement allows Lesotho, Namibia and Swaziland (LNS countries) to issue their national currencies, the Lesotho Loti, the Namibian dollar, and the Swaziland Lilangeni, respectively, but these are pegged to the South African rand on a one-to-one exchange rate. The terms of the CMA agreement implied that the LNS countries became responsible for their own monetary policies and assumed control of their own financial institutions, albeit to a limited extent. One of the most salient features of the CMA is that South Africa is the single large dominant country, which accounts for over ninety percent of the CMA's gross domestic product (GDP), trade and population. Seleteng (2013) refers to this CMA arrangement as an asymmetric monetary union considering that South Africa has substantial dominance in terms of monetary policy formulation in the region. However, the CMA is not a full monetary union because there is no single central bank responsible for monetary and exchange rate policy formulation in the region and no shared pool of external reserves. There is also neither an official surveillance of domestic fiscal and structural policies in the region to ensure that these remain consistent, nor a set mechanism for fiscal transfers to mitigate the impact of asymmetric shocks on member states (Masson and Pattilo, 2002; Asonuma, Debrun and Masson, 2012; Seleteng, 2013).

As much as South Africa is dominating the BLNS countries, a full monetary union would formalise most of what is already happening giving all SACU member countries an opportunity to experience the benefits of a full monetary union. Therefore, a formalisation is necessary as it would provide a formal regional central bank which 'looks out' for all member countries' needs, an official regional surveillance of domestic fiscal and structural policies for all member countries, as well as a prescribed fiscal transfers mechanism to moderate the impact of asymmetric shocks on member states.

### **1.2. A full monetary union**

The above features, if addressed, could enhance the macroeconomic stability of all the member countries (Seleteng, 2013). In particular, establishing full monetary integration in the SACU region could possibly improve the credibility of monetary policy for the BLNS countries by ensuring that the centralised monetary policy stance takes into consideration economic developments and shocks in all countries.

Given the extent of the dominance of the South African economy, the regional monetary policy is expected to have a limited sensitivity to the business cycle movements in one of the smaller member countries. Furthermore, according to Masson and Pattilo (2003), a full monetary union involves setting up a regional central bank that could enforce discipline and consistency among member countries as well as provide formal regional surveillance of domestic policies. With full monetary integration, monetary conditions are set by an independent common central bank in line with the average macroeconomic environment in that particular region.

A common monetary policy may lead to symmetric or asymmetric effects, which depend on country-specific characteristics such as business cycle conditions and economic structures. Therefore, it is necessary to establish whether or not the group of countries in a region are affected in a similar way by the common monetary policy. According to Van Aarle, Engwerda, Plasmans and Weeren (2001), full monetary integration would be ideal in a situation where the common monetary policy affects economic conditions (such as GDP, prices etc) in the respective group of countries involved in a similar manner. If conditions are effected similarly, one would expect close convergence in the behaviour of variables such as GDP and prices across countries.

However, there are costs associated with adopting full monetary integration, which include loss of exchange rate adjustment flexibility, loss of national sovereignty, loss of seignorage and weakened accountability of policymakers to the national citizenry. Also, member countries lose monetary policy autonomy and have a limited ability to deal with asymmetric shocks. Despite these challenges, Sturm and Siegfried (2005) argue that there is room for achieving full monetary integration, even if member countries are prone to asymmetric shocks. Full monetary integration would be feasible if member countries coordinated their macroeconomic policies. Moreover, coordination of policies helps economies to absorb internal and external shocks, thereby minimising the impact on economic growth and unemployment, leading to higher welfare for all economies.

The discussion above raises the question of whether or not there is room for full monetary integration in the SACU region, which would be an upgrade of the current CMA to a SACU monetary union.



This study answers this question by drawing on the experience of the European Monetary Union (EMU), which shows that achieving macroeconomic convergence at national level is essential for full monetary integration in the form of a stable monetary union and an independent central bank (Masson and Pattilo, 2002). Also, a necessary outcome of macroeconomic convergence is macroeconomic stability, where macroeconomic convergence in the European region is mostly measured and monitored by the following indicators: the rate of inflation in each member country, the ratio of the budget deficit to GDP, the ratio of public and publicly guaranteed debt to GDP, and the balance and structure of the current account (Banda, Onwioduokit and Simwaka, 2012).

According to EU (2020), the macroeconomic convergence criteria used in the European Union were initially set in the Maastricht Treaty in 1992, laying the foundation for the creation of a single currency and the common European Central Bank (ECB) and, by extension, the formation of the European Monetary Union (EMU).<sup>4</sup> The EMU focuses on the coordination of economic and fiscal policies, a common monetary policy, and a common currency, called the euro. The convergence criteria highlighted the economic conditions necessary to ensure that potential EMU member states were ready to become part of a fully-fledged monetary union. The Maastricht criteria were later enshrined and complemented by the Stability and Growth Pact (SGP), concluded in 1997, and fully implemented by 1999 (EU 2020).<sup>5</sup> The SGP ensures that European Union countries practice sustainable public finances and coordinate their fiscal policies. Therefore, targets for inflation rates, public deficit- and debt-to-GDP ratios, exchange rates and, and long-term interest rates are the macroeconomic convergence criteria enshrined in the Maastricht Treaty and the SGP.

The main objective of the criteria is to ensure that there is a convergence of the potential EMU member countries' economic policies and that there is no macroeconomic instability as new countries join the monetary union. To comply with the macroeconomic criteria, a set of economic policies is usually adopted.

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<sup>4</sup> The Maastricht Treaty was signed in 1992 but it officially came into force on 1 November 1993 when the European Union was officially established (its predecessor was named the European Economic Community).

<sup>5</sup> The SGP's preventive rules were implemented in 1998, and its corrective rules in 1999.

“These policies must be coordinated within the group of member countries and need to move in the same direction, but do not necessarily have to be identical” (Banda *et al.*, 2012:15). Ways of attaining macroeconomic convergence include member countries coordinating their actions or having a dominant country in the region that steers the policy direction for smaller member countries to follow. As this thesis will show, the latter is a condition applicable to the SACU region.

### **1.3. Fiscal and monetary spillover effects**

According to Zhang (2012), forming a full monetary union is associated with significant policy harmonisation, increased monetary and fiscal policy interdependence within the region and the effect that one country’s policies can have on other member countries. These *spillover effects* could substantially limit member countries’ ability to implement independent economic policies and, therefore, enhance the argument for macroeconomic convergence. To achieve macroeconomic convergence for full monetary integration, it is necessary to consider the macroeconomic performance and stability of the countries in question as well as their mutual interdependence, particularly in terms of macroeconomic policies. Moreover, how policy in one country spills over to other member countries is one of the aspects to be considered for macroeconomic convergence and whether member countries have symmetric or asymmetric responses to common external shocks (this speaks to macroeconomic stability). Therefore, this study approaches the convergence assessment from the view of establishing the extent of monetary and fiscal policy spillovers and coordination among the SACU countries. Full monetary integration will be ideal if the BLNS countries’ economies have similar reactions to the South African monetary and fiscal policy and financial development spillovers.

Furthermore, for a fully-fledged monetary union to be possible, the economies in the region should have coordinated and convergent policies. One of the prerequisites necessary for attaining full monetary integration is that the macroeconomic policies of the prospective monetary union members should be stable, coordinated, prone to similar shocks, and exhibit similar responses to these shocks. According to Banda *et al.* (2012), true integration takes place when member countries in the region deal with shocks in a coordinated manner.

Therefore, an essential element in assessing the state of integration is analysing the extent of macroeconomic policy coordination in and among the potential union member countries. A sign that policy coordination in the regional economic community (REC) is achieving the desired macroeconomic targets is the degree of macroeconomic convergence. Convergence would provide the necessary foundation for moving the REC through the various phases of integration towards a fully-fledged monetary union (Banda *et al.*, 2012: 34).

With increased monetary integration, member countries have high economic interdependence because of a common currency and monetary policy. There is also a higher likelihood of economic policies and developments in one country spilling over into other member countries. In other words, member countries are faced with a possible increase in the transmission of economic shocks within the region, and, in some instances, this shock transmission can differ from one country to another. Full monetary integration therefore implies the need to coordinate macroeconomic policies. Because full monetary integration potentially creates challenges for member countries in dealing with country-specific shocks, it needs to be supported by appropriate economic policy such as fiscal policy (Kirakul, 2012). For example,

...the European Economic and Monetary Union demonstrates that a centralized monetary policy may be compatible with a decentralized fiscal policy framework, where national governments remain solely responsible for economic policies but are required to engage in policy coordination and must respect a set of common rules for the conduct of their fiscal policies (Puetter, 2019)

The Common Monetary Arrangement (CMA) is the longest-standing monetary union and is the closest arrangement to full monetary integration in Africa. The CMA, as part of the Southern African Customs Union (SACU) region, is highly integrated and has the potential for significant policy spillovers among the member countries. This raises the question of the magnitude of monetary and fiscal policy spillovers as well as how much monetary and fiscal policy coordination exists among the SACU countries, given the extent of interdependence in the region.

Monetary and fiscal policy coordination contributes to macroeconomic convergence of member countries, and this is a crucial criterion for determining whether or not the SACU countries can attain macroeconomic convergence for full monetary integration. Several studies have looked at the level of coordination of policies and macroeconomic convergence to assess the feasibility of full monetary integration within the African region (e.g. Patroba and Nene, 2013; Maleke, 2008; Masson and Pattillo, 2002; Bawumia, 2002; Fwangkwal, 2014). These studies are based on the rationale that coordination of monetary policies enables the member countries to converge, which is one of the key prerequisites for the feasibility of full monetary integration. Patroba and Nene (2013) investigate the readiness of SACU to be a full monetary union by examining the level of macroeconomic convergence within the region.

Based on the Southern African Development Community (SADC) convergence criteria, which looks at levels of inflation, fiscal deficits, national debt, and reserve requirements, Patroba and Nene (2013) find that there is convergence in monetary and fiscal policies among the SACU countries. They conclude that establishing a monetary union would be beneficial for the SACU countries. Similarly, in investigating the degree of macroeconomic convergence in the SACU region, Maleke (2008) and Kabundi and Loots (2007) find evidence of macroeconomic and monetary policy convergence. These findings of high convergence among SACU countries provide support for the feasibility of setting up a full monetary union.

In examining the feasibility of full monetary integration in West Africa, Bawumia (2002) argues that the West African Monetary Zone (WAMZ) is not feasible because the performance of the countries does not meet the ECOWAS convergence criteria.<sup>6</sup> Similarly, Fwangkwal (2014) focuses on the extent of monetary integration in the ECOWAS and finds that the West African countries have not met the ECOWAS convergence criteria.

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<sup>6</sup> The macroeconomic convergence criteria contains primary and secondary criteria. The primary criteria includes: at most 4 percent of budget deficit to GDP ratio; at most 5 percent of the inflation rate; Central Bank Financing of Budget Deficit of less or equal 10 percent of previous year's Tax Revenue and Gross External Reserves of at least 6 months of imports cover. Moreover, the secondary criteria includes: prohibition of new arrears and liquidation of all outstanding ones; At least 20 percent of tax receipts to GDP ratio; at most 35 percent of salary mass to total tax receipts ratio; at least 20 percent public investments financed from internal resources to tax receipts ratio; positive real interest rates; and stable real exchange rate (Fwangkwal, 2014).

Therefore, as much as these countries are integrated, their level of monetary integration still falls short of the desired level of macroeconomic convergence for a full monetary union with a regional central bank.

Furthermore, the issue of spillovers across countries points towards the need for these economies to coordinate their policies to better deal with domestic and foreign economic shocks. In establishing full monetary integration in the SACU region, one of the major convergence challenges that member countries should consider is the spillover effects of policy shocks in this region. Considering the close monetary relations among SACU countries and the dominance of South Africa, South Africa *de facto* decides monetary policy in the region. If South Africa is indeed dominant, the effects of South African monetary policy may spill over to the other SACU countries through the monetary policy instruments (e.g. interest rates) and the policy target variables (inflation and, to a lesser extent, output). With limited scope for an independent monetary policy, the BLNS countries are likely to depend on their fiscal policies to influence their respective economies. However, here too, South Africa possibly dominates, with the effects of its fiscal policy spilling over into the BLNS countries.

Therefore, the magnitude of the spillover effects from South Africa to the BLNS countries would point towards the need and ease with which SACU member countries can attain full monetary integration as well as raise the question of whether or not the SACU countries should coordinate their monetary and fiscal policies. In particular, given South Africa's regional dominance, this study focuses on policy-induced spillovers that are a direct effect of South Africa policy measures on other SACU countries. Through exploring monetary and fiscal policy transmission channels, one can identify the path through which these policy effects move from one country to another. Because monetary and fiscal policies have an impact on critical macroeconomic policy objectives, there is a need for policy coordination. According to Oboh (2017:48), "effective coordination between fiscal and monetary policy authorities helps immensely in fast-tracking the achievement of stated policy objectives more efficiently".

The EMU mandate supports the notion of policy coordination as it involves the coordination of economic policymaking between member countries, coordination of fiscal policies, a common monetary policy run by an independent central bank and a single currency, the euro. Moreover, the conduct of fiscal policy authorities is as important as the monetary authority in conducting appropriate monetary policy rules. In particular, an unsustainable fiscal policy can affect monetary policy rules that involve inflation targeting by causing deviations from policy targets in the member countries (Cevik, Dibooglu and Kutan, 2014).

#### **1.4. Financial Development, fiscal and monetary policy**

While monetary and fiscal policies can improve macroeconomic performance directly, they can also influence the relationship between financial development and economic growth, while financial development influences the effectiveness of monetary and fiscal policies. According to Hye and Islam (2013), establishing a stable macroeconomic (fiscal and monetary policies) and political environment is necessary for financial development strategies to be a success. Shallow financial systems limit fiscal and monetary policy choices as well as hamper macroeconomic policy transmission and, by extension, the success of macroeconomic convergence for full monetary integration.

Apart from monetary policy being transmitted through the interest rate channel, it can operate through the credit channel (which itself can operate regionally). The credit channel requires credit extension market depth, and one way to measure that depth is the ratio of credit extended relative to GDP. Fundamentally, monetary policy is a financial process targeting certain macroeconomic variables, with the financial system linking central bank policies and the real economy through the monetary transmission mechanism (Ma and Lin, 2016). Therefore, a well-developed financial system has the potential and capacity to improve monetary policy transmission and to accelerate a country's economic growth, also on regional level (Pradhan, Arvin, Norman and Bahmani, 2019; Jedidia, Boujelb and Hela, 2014).

Because governments are some of the largest borrowers in financial markets and influence economic growth, fiscal policy is one of the policies that have the potential to influence the development of financial systems.

Thus, fiscal policy needs to be incorporated in the exploration of the relationship between financial development and economic growth (Rafindadi and Yusof, 2013; Benyah, 2010). Also, an underdeveloped financial system constrains fiscal policy and limits its use as a countercyclical policy instrument, particularly in recession and crisis periods (Caballero and Krishnamurthy, 2004). The discussion above indicates that the effectiveness and efficiency of macroeconomic policy operations might affect the growth prospects and development of financial markets, while the extent of financial development can also affect the effectiveness of monetary and fiscal policy operations. Considering the effect of the relationship between financial development and economic growth, this thesis therefore investigates both monetary and fiscal policy spillovers among the SACU countries and their effect on the relationship between financial development and economic growth.

Examining the direction of the relationship between financial development and economic growth furnishes the policymakers with relevant information on whether to focus on policies that enhance financial development to boost economic growth or policies that boost economic growth to have a well-developed financial system, or policies that strike a balance between the two possibilities. The implication is that the opposing views on this relationship pose a challenge to many countries “whether to promote financial development as a productive input or whether they should concentrate on economic activities that will promote financial sector development” (Ginevicius *et al*, 2019:3311). Therefore, this study also seeks to establish the nature of the relationship between financial development and economic growth in SACU countries, while controlling for South African financial development (which subsumes the monetary dimension), as well as domestic and South African fiscal policies. Financial development and economic growth lays the foundation for the effective operation of fiscal and monetary policy and spillover effects of such policies among member countries.

With pronounced cross-border market linkages among the SACU countries, there is a high likelihood for financial development shocks to be transmitted from an economically and financially developed country like South Africa to the other SACU countries.

Although cross-border financial development spillovers occupy an important place in the international finance literature, these have not been explored for the SACU countries in a context that incorporates domestic and foreign fiscal policy effects. Financial development spillovers are defined as the direct effect of one country's financial system development on another country's financial system development or economic growth (Bara and Le Roux, 2017). Part of the focus of this thesis is exploring how the interdependencies in financial linkages among countries complement spillover effects of financial development from South Africa to the BLNS countries' financial development or economic growth.

The BLNS countries are highly integrated with South Africa and thus, each country in the region needs to know its capacity (strengths and weaknesses) to deal with South Africa's dominance and shocks for better arrangements and negotiations with South Africa and the other countries in the region. The degree of spillover effects and policy coordination in the SACU would point towards the need and ease with which SACU member countries can attain full monetary integration.

## **2. OBJECTIVES OF THE STUDY**

Based on the discussion above, the monetary and fiscal policy spillovers from South Africa to other SACU countries could, in principle, be particularly strong, thereby pointing towards a need for policy coordination. Because the macroeconomic convergence criteria for the establishment of a fully-fledged monetary union focuses mainly on monetary and fiscal policy variables, this thesis will only focus on fiscal and monetary policy spillover effects from South Africa to the BLNS countries as well as their extent of coordination. This will involve looking at whether or not monetary and fiscal policy variables in the BLNS countries react the same way to changes in their South African counterparts. The rationale behind the focus on monetary and fiscal policy spillovers and coordination is that it would help ascertain whether or not there are grounds for serious consideration of the SACU attaining full monetary integration, and becoming a fully-fledged monetary union. Therefore, the main objective of the study is to ascertain the nature and extent of monetary and fiscal policy spillover effects and coordination in the SACU region. This, in turn, assists in answering the main question posed in this thesis: is there a sufficient economic, fiscal and monetary policy case for the SACU region to become a fully-fledged monetary union?



If South African monetary policy dominates that of the other SACU countries, while the latter mainly just mimic South African monetary policy, then a case might exist to move towards full monetary integration, with a regional central bank. The case is strengthened if South African macroeconomic variables such as inflation, economic growth and interest rates also spill over onto their SACU counterparts. That still leaves fiscal policy and its interaction with monetary policy, both within and between SACU countries. Given the sovereignty of the various SACU countries, fiscal policy is unlikely to be centralised into a single fiscal authority. However, should the South African fiscal policy affect the other SACU countries to a large extent, and should monetary policy be centralised in a common central bank, the SACU members will need to coordinate their fiscal policies. Fiscal policy conduct also has implications for the relationship between financial development, which is another avenue of monetary policy, and economic growth. Thus, SACU countries need to consider how domestic and South African fiscal policies spill over into the relationship between financial development and economic growth.

To address these questions and assist in realising the main objective set out above, the thesis will focus on four objectives, each addressed in a separate article as follows:

*ARTICLE I – The South African Dominance Hypothesis (SADH): Evidence in the SACU region*

The main objective is to establish whether or not the South Africa dominance hypothesis holds in the SACU region. This objective is achieved by addressing the following secondary objectives:

- i. To analyse the extent of financial integration among SACU countries.
- ii. To investigate if there are any significant economic linkages among SACU countries.
- iii. To establish if there is evidence in favour of the South African dominance hypothesis, i.e. to check if the spillover between SACU countries is predominantly one-directional.

### ARTICLE II – Monetary policy spillovers in the SACU region

The main objective of this article is to explore the extent and effects of South African monetary policy spillovers on the BLNS countries, and it is addressed through the following secondary objectives:

- i. Use a Phillips curve relationship to establish whether or not South African inflation spills over to the inflation of other SACU countries.
- ii. Use a Taylor-type monetary reaction function to assess how the monetary authorities in the BLNS countries react to South African policy interest rates.
- iii. To establish whether or not there is interest rate pass-through from South Africa to the other SACU countries.

### ARTICLE III – Monetary and fiscal policy coordination in the SACU region

Considering the nature and degree of interdependence in the SACU region, the main objective of this article is to determine the extent of coordination between fiscal and monetary policy, from a regional perspective. The secondary objectives are:

- i. To investigate the degree of spillover effects between South African fiscal policy and the fiscal policies of the BLNS countries.
- ii. To establish whether or not the BLNS country monetary policies react to their respective fiscal policies and South African fiscal policy.
- iii. To establish whether or not BLNS country fiscal policies respond to South African monetary policy.

### ARTICLE IV – Linkages between financial development, economic growth and fiscal policy in the SACU area

The main objective is to explore the role of domestic and South African fiscal policy and South African financial development in the relationship between financial development and economic growth in the SACU countries. The main objective is addressed through the following secondary objectives:

- i. To establish the existence, nature of the relationship, and direction of causality between financial development (FD) and economic growth (EG) in the SACU countries, i.e.  $\{FD_{SACU} \leftrightarrow EG_{SACU}\}$ .

- ii. To investigate the effect of fiscal policy in the finance-growth nexus in the SACU countries, i.e. Fiscal policy (SACU)  $\rightarrow \{FD_{SACU} \leftrightarrow EG_{SACU}\}$ .
- iii. To establish whether or not there are South African fiscal policy spillover effects on the relationship between financial development and economic growth of the other SACU countries, i.e. Fiscal policy (SA)  $\rightarrow \{FD_{BLNS} \leftrightarrow EG_{BLNS}\}$ .
- iv. To establish whether or not there are South African financial development spillover effects in the relationship between financial development and economic growth of the other SACU countries taking into account the BLNS country's fiscal policy, i.e.  $FD_{SA} \rightarrow \{FD_{BLNS} \leftrightarrow EG_{BLNS}\}$ .

### **3. WHY THE SACU?**

The SACU countries have been chosen because there is potential dominance of South Africa in the region and the countries provide the opportunity to assess the spillovers of monetary and fiscal policy effects. Close real and financial interlinkages are potentially a valuable source of spillovers in the SACU region. South Africa, as the largest SACU economy, accounting for over 90 percent of SACU's GDP and trade, is a prime candidate for being the source of spillovers to other SACU countries (Asonuma *et al.*, 2012). South Africa also has strong financial and trade links to the other SACU countries, which could be channels of shocks from South Africa to the other SACU countries (BLNS). In the SACU region, South Africa is a relatively more critical market destination for the BLNS countries than *vice versa*. The BLNS exports to South Africa are a significant portion of their GDP, meaning that any effects on South African exports are likely to be transmitted to the other SACU countries through their dependence on South African exports. This is an indication of the dominance of South Africa in the region.

Furthermore, four of the SACU countries, South Africa, Lesotho, Namibia and Swaziland, constitute the Common Monetary Area (CMA), the oldest existing monetary union in the world. In the CMA, Lesotho, Namibia and Swaziland (LNS countries) pegged their national currencies (Lesotho Loti, Namibian dollar, and the Swaziland Lilangeni) on par with the South African rand, which circulates freely in the LNS countries alongside the LNS currencies. As much as Botswana is not part of the CMA, the Botswana pula exchange rate is based on a currency basket in which the rand carries a weight of 60-70%.

Therefore, South Africa has some dominance over the BLNS countries since these countries maintain a peg to the South African rand. Subramanian and Kessler (2013) confirm that the economic dominance of a country is signified when its currency becomes a reference point for other countries' currencies where they implicitly or explicitly track it.

In addition to the currency dominance of the South African rand among SACU countries, South Africa *de facto* decides monetary policy in the region (Aziakpono, 2008). LNS countries have limited, if any, control in using monetary policy as a stabilisation tool in their economies because they follow the decisions of the South African Reserve Bank's Monetary Policy Committee (MPC). Therefore, if South Africa is indeed dominant, the effects of South African monetary policy may spill over to the other SACU countries through the monetary policy instruments (interest rate) and the policy target variable, inflation and, to a lesser extent, output.

Regarding the financial sector, the financial systems of BLNS countries are highly integrated with that of South Africa. South African banks dominate the banking sector of the SACU countries, in most cases holding controlling interests in the major banks in the BLNS countries. According to Aziakpono (2008:8), "the high degree of South African ownership coupled with membership of the CMA ensures that the banking sectors in the LNS countries follow South African trends in product innovation and pricing." Also, the central banks of Lesotho, Namibia, and Swaziland set their total reserves equal to the amount of currency in circulation, funds flow freely within the CMA, and the LNS countries have access to South African money and capital markets (Wang *et al.*, 2007).

Because of a limited scope for an independent monetary policy and national sovereign fiscal policies, the LNS countries are likely to depend on their fiscal policies to influence their respective economies. On the fiscal policy side, the SACU countries share customs revenue, which is "distributed according to a formula that depends on the amount of intraregional trade of each country" (Canales-Kriljenko, Gwenhamo and Thomas, 2013:14). The customs revenue to be distributed depends on South African imports from the world, and these imports are partly determined by South African monetary, fiscal and financial policies as well as political and social events that may disrupt economic conditions (Canales-Kriljenko *et al.*, 2013).

BLNS countries have small tax bases, which could contribute to fiscal revenue uncertainty in the region. Thus, there is a need for proper management of fiscal volatility as fiscal mismanagement by the individual SACU countries could result in excessive fiscal stress such as large deficits and high public debt and, in principle, could give rise to sharp fluctuations in real activity. Such consequences are usually detrimental to an economy and undermine the credibility of low inflation commitment. Because of highly integrated SACU countries, high deficit spending by one SACU country could be costly for the other SACU countries. It is therefore essential to establish how fiscal policies spill over within the SACU region.

Therefore, given that the BLNS countries are primarily dependent on the South African economy, follow South African monetary policy, and have access to South African financial markets, the expectation is that the policy developments in South Africa will spill over to the BLNS countries. Reverse spillover, in principle, is possible, but, probably of limited impact because of the size of the South African economy relative to the BLNS countries.

#### **4. CONTRIBUTION OF THE STUDY**

This study presents original research on the nature of policy interdependence in the SACU region. It will provide estimates of the direction and magnitude of policy spillover from South Africa to the other SACU countries. As much as there is literature on the policy spillovers, information on the sign, size, and timing of spillover in the SACU area is still far from complete. Existing literature mostly covers spillovers in a full monetary union setup, while the contribution of this study is that its spillover analysis focuses on a group of SACU countries that are not in a full monetary union. This study also extends research by Aziakpono (2008) by establishing the role of fiscal policy in the relationship between financial development and economic growth in the SACU countries. The financial development and fiscal policy spillovers from South Africa to the BLNS countries are also examined in the thesis. Furthermore, this study seeks to contribute to the understanding of the nature of fiscal and monetary policy interactions (i.e. cross-policy spillovers) in the SACU region. To the author's knowledge, no studies for the SACU countries have focused on this type of analysis up to date.

All the above aspects speak to the main contribution of this study, which is the conclusion about the structure of monetary and fiscal policy management. The study seeks to ascertain whether or not SACU should and could become a fully-fledged monetary union given the degree of policy spillover effects and coordination among the member countries. Therefore, this study would provide valuable insight into the issues of the interaction between monetary and fiscal policies and spillovers and the role of fiscal policy and financial development spillovers in the relationship between financial development and economic growth across the SACU region. Moreover, this study demonstrates how financial development is related to economic growth and provides policy recommendations for SACU economies.

## **5. CONCLUSION**

According to McCarthy (2012), full monetary integration is one of the highest forms of integration, and it involves assigning the responsibility of formulating and implementing monetary and exchange rate policies to a regional central bank, having a single currency as well as having formal regional surveillance of domestic economic (fiscal and structural) policies of the member countries. The focus of this study is on establishing whether or not there is room for the SACU countries to create a full monetary union by investigating the nature and degree of policy spillover effects and coordination across the region. The SACU is the longest-standing customs union in Africa, with South Africa largely dominating the other four countries (Botswana, Lesotho, Namibia, and Swaziland – BLNS countries) economically.

Four of the SACU countries are part of the Common Monetary Area (CMA), an asymmetric and informal monetary union. The CMA has no regional central bank, no shared pool of external reserves, no official regional surveillance of domestic fiscal and structural policies, and no prescribed mechanism for fiscal transfers to moderate the impact of asymmetric shocks on member states (Masson and Pattilo, 2002; Asonuma *et al.*, 2012; Seleteng, 2013). Because the SACU is not a fully-fledged monetary union, the question arises, whether or not there is room for full monetary integration in the SACU region, which is an upgrade of the current CMA to a SACU monetary union.

To answer this question, this study takes from the experience of the European Monetary Union (EMU), which shows that achieving macroeconomic convergence at national level is essential for full monetary integration (Masson and Pattilo, 2002). The macroeconomic convergence criteria used in the European Union highlights the economic conditions necessary to ensure that potential EMU member states are ready to become part of a fully-fledged monetary union. The macroeconomic convergence concept for a full monetary integration arrangement implies that member countries should meet some macroeconomic targets considered as benchmarks for sustained macroeconomic stability, with the main ones relating to inflation, monetary and fiscal conditions, and the external sector position. To comply with the macroeconomic targets, a set of economic policies is usually adopted. However, macroeconomic convergence and policy coordination are necessary, but not sufficient, conditions for full monetary union. There is also the institutional and political dimensions, which are not discussed in this thesis. This means that the focus of this thesis is limited to the discussion of the economic, fiscal and monetary policy preconditions for complete monetary integration.

Thus, to conclude, due to the increased economic interdependence within the region and the effect that one country's policies can have on other member countries, full monetary integration requires significant policy coordination and expansive convergence of fiscal and monetary policies. This thesis establishes the degree of such coordination to conclude whether or not SACU countries are ready for monetary integration.

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**ARTICLE I**  
**THE SOUTH AFRICAN DOMINANCE HYPOTHESIS (SADH): EVIDENCE IN THE**  
**SACU REGION**

**1. INTRODUCTION**

In the SACU region member countries have increasingly integrated economic and financial systems as well as increased international trade of goods, services and financial assets. The SACU region comprises South Africa and the BLNS countries (Botswana, Lesotho, Namibia and Swaziland). According to Majewska and Jamroz (2018: 235), “integration is one of the most important aspects of the development and growth of financial markets.” Financial integration is a broad subject with no universal definition, but it most commonly refers to a situation where countries among themselves do not face any significant financial market restrictions. Benefits of financial integration among countries include:

- Promotion of financial development and, therefore, contributing to economic growth (Majewska and Jamiroz, 2018:236)
- Stimulated and smoother international investments because of increased capital mobility, which promotes growth beyond the limits of domestic saving (Slimane, Tahar and Essid, 2013)
- Improved opportunities to share risk by allowing for more substantial insurance benefits and more efficient consumption smoothing (Billio, Donadelli, Paradiso and Riedel, 2017).

However, financial integration can also be a threat to economies as it allows for the transmission of shocks and adverse changes such as contagion of the financial crisis between countries. Also, financial integration can significantly limit the benefits of risk diversification because of increased market volatility. It is possible that these costs and benefits of higher integration can be different between the dominant countries and the smaller economies. Thus, the question of whether integration happens would likely come down to a social responsibility and/or a political one, which is beyond the scope of this thesis. Furthermore, the degree of integration among financial markets and across countries has important implications for economic theory, effectiveness of economic policies and decisions of policymakers (Volosovych, 2013; Billio *et al.*, 2017).

Because financial integration is a necessary though not a sufficient condition for the existence of dominance, this article examines the extent of financial integration among the SACU countries followed by testing the South African dominance hypothesis for the SACU region.

In such regional arrangements, some economies are large and dominant in the region, while others are small. One of the significant challenges that small countries face when attempting to maintain economic stability is the spillover of economic shocks from dominant economies to which they are connected. D’Auria, Linden, Monteiro, Veld, and Zeugner (2014) define spillovers as the transmission of the effect of a shock in one economy through various channels to another economy. The nature of spillover effects depends on the transmission mechanisms, the source, and type of shock hitting the economy, as well as the state of the source and destination economies (D’Auria *et al*, 2014). Some of the particular causes of such economic shocks are monetary and fiscal policy. The magnitude and relevance of these policy effects tend to vary with the state of the economy. In particular, economies that are dependent on a dominant trading partner are likely to have their monetary and fiscal policy actions and transmission mechanisms linked to those of the dominant country.

In the Southern African Customs Union (SACU), South Africa is a dominant country with Botswana, Lesotho, Namibia and Swaziland (the BLNS countries) mostly dependent on South Africa (Canales-Kriljenko, Gwenhamo and Thomas, 2013:14); thus the investigation of the “South African dominance hypothesis (SADH)”. The SADH is defined here as the dominant position of South Africa within the SACU region. The presence of the SADH means that it becomes difficult for the BLNS countries to pursue their macroeconomic policies independently, in particular their monetary and fiscal policies. Necessarily, the dominance hypothesis entails an assertion that other countries’ actions are largely influenced by the activities of the dominant state. As South Africa is the largest SACU economy, accounting for over 90% of SACU’s GDP and trade, it is a prime candidate for being the dominant economy among SACU countries and, hence, a potential source for spillovers to the BLNS countries.

According to Subramanian and Kessler (2013:1), a country’s economic dominance involves its currency becoming the primary currency or a reference point, with the other currencies tracking it implicitly or explicitly.

Such dominance is evident in the SACU region since four of the SACU countries, South Africa, Lesotho, Namibia, and Swaziland, form a monetary union, established in 1974, called the Common Monetary Area (CMA)<sup>7</sup>. In this CMA, Lesotho, Namibia, and Swaziland (LNS) have their national currencies pegged through a currency board on par with the South African rand, and the rand circulates freely in the LNS countries alongside the LNS currencies (the Lesotho Loti, Namibian dollar, and the Swaziland Lilangeni). Although Botswana is not part of the CMA, the value of the Pula is set against a currency basket in which the rand carries a weight of about 60-70%. Therefore, South Africa has some dominance over the BLNS countries since these countries maintain a peg to the South African rand. Given the close currency relations among SACU countries and the dominance of South Africa, South Africa *de facto* decides monetary policy in the region (Aziakpono, 2008). LNS countries follow the decisions of the South African Monetary Policy Committee (MPC) and have limited control in using monetary policy as a stabilisation tool in the LNS economies. Therefore, if South Africa is indeed dominant, the effects of the South African monetary policy may spill over to the other SACU countries through the monetary policy instruments (interest rate) and the policy target variables, inflation and, to a lesser extent, output.

Furthermore, on the fiscal policy side, the SACU countries share customs revenue, which is “distributed according to a formula that depends on the amount of intraregional trade of each country” (Canales-Kriljenko *et al.*, 2013:14). The customs revenue linkage to South Africa arises because South African imports from the world determine the total customs revenue to be distributed. In turn, South African monetary, fiscal and financial policies as well as political and social events that may disrupt economic conditions partly determine these imports (Canales-Kriljenko *et al.*, 2013). Trade is also one of the crucial channels of contagion in the SACU region (Canales-Kriljenko *et al.*, 2013). In the SACU region, South Africa is a relatively more important market destination for the BLNS countries than vice versa. This is another indication of the dominance of South Africa in the region.

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<sup>7</sup> Botswana was initially part of the monetary arrangement when it was established in 1974 but opted out in 1975.

South African banks dominate the banking sector of the SACU countries, in most cases holding controlling interests in the major banks in the BLNS countries. According to Aziakpono (2008:8), “the high degree of South African ownership coupled with membership of the CMA ensures that the banking sectors in the LNS countries follow South African trends in product innovation and pricing”. Hence, the financial systems of BLNS countries are highly integrated with that of South Africa.

Given that the BLNS countries are primarily dependent on the South African economy and follow South African monetary policy, the expectation is that the policy developments in South Africa will spill over to the BLNS countries. In light of the above discussion, the main objective of this article is *to establish whether or not the South Africa dominance hypothesis holds in the SACU region*. This objective is achieved by addressing the following secondary objectives:

- i. To analyse the extent of financial integration among SACU countries.
- ii. To investigate if there are any economic spillovers among SACU countries.
- iii. To establish the direction of the economic spillovers.
- iv. To establish if there is evidence in favour of the South African dominance hypothesis, i.e. to check if the spillover between SACU countries is predominantly one-directional.

## **2. LITERATURE REVIEW**

The discussion below presents an overview of the literature on financial integration and the dominance hypothesis.

### **2.1. Measuring financial integration**

Much of the attention to the financial integration literature has been devoted to measuring it. There is a wide range of measures of financial integration, mainly because this concept encompasses different dimensions. Some of the measures included are presented in Table 1 below:

Table 1: Dimensions of measures of financial integration

Measure	Description	Literature examples
Price-based measures	Look at the relationship between prices of similar assets across countries	Babecky, Frait, Komarek and Komarkova (2010); Bekaert, Engstrom, and Xing (2009); Yu, Fung and Tam (2010); Jayasuriya (2011); Gupta and Guidi (2012); Donadelli and Paradiso (2014); Michela, Elisa, Evangelia and Eduardo (2017)
Quantity-based measures	Focus on stock or flow data-based measures	Baele, Ferrando, Hordahl, Krylova and Manet (2004); Baltzer, Cappiello, De Santis and Manganelli (2008); Vodova (2011)
News-based measures	Look at how news affects asset prices in different markets or countries	Baele <i>et al.</i> (2004); Baltzer <i>et al.</i> (2008); Vodova (2010)
Correlation-based measures	Look at the correlation coefficients of financial variables	Campbell, Koedijk, Kofman (2002); Ang and Bekaert (2002); Quinn and Voth (2008); Olbry's and Majewska (2017)
Cointegration tests	Look at how different variables are cointegrated	Kizys and Pierdzoch (2011); Guidi and Ugur (2014); Beukes (2015); Oanea (2015); Al Nasser and Hajilee (2016); Lehkonen (2015)
Principal component analysis	Looks at identifying the principal components/common factors	Jareno and Tolentino (2012); Juneja (2012); Zheng, Podobnik, Feng and Li (2012); Volosovych (2013); Fat and Dezsi (2012); Pretorius and Kabundi (2014); Yang and Rea (2015); Yang (2015); Mahajan and Verma (2015); Majewska and Jamroz (2018); Billio <i>et al.</i> (2017); Lee (2017); Monte (2018); Coleman, Leone and De Medeiros (2019)
Investment-saving correlation (I-S)	Postulates that in highly integrated countries there will be a limited or no relationship between domestic investment and domestic saving	Irlandoust (2019); Ginama, Hayakawa and Kanmei (2018); Khan (2017); Drakos, Kouretas, Stavroyiannis and Zarangas (2017); Mitra (2015); Kumar (2015); Chen and Shen (2015); Johnson and Lamdin (2014); Di Iorio and Fachin (2014); Ketenci (2012); Aziakpono (2008)

In all the above measures, the prevailing notion is that with high financial integration there must be minimal discrepancies in how financial products and services move or react across countries. This notion is highlighted by Volosovych (2013:361), who states that the comovement of assets is a broad measure of financial integration because, in an integrated economy, one would observe more comovement.

In other words, comovements between countries or financial markets tend to rise as they become more integrated. According to Billio *et al.*, (2017:2), the main challenge regarding measuring the extent of financial integration is in using a measure that finds a balance between the complexity of computation and accuracy of measurement. Furthermore, the literature table in the appendix presents examples of studies that use PCA and I-S correlation.

For structure, the literature highlighted in the table only focuses on principal component analysis (PCA) and investment-saving (IS) frameworks, which are the measures used in this study for measuring financial integration. These two measures are used in this study because they are the most commonly used in literature (Aziakpono, 2008; Billio *et al.*, 2017; Ginama *et al.*, 2018). They are also the most relevant because they incorporate some elements of all the other measures not used. In other words, a PCA is done on price-based measures (interest rates) and quantity based measures (GDP, debt), while the I-S correlation analysis is done on quantity-based measures, investment and savings. The PCA also incorporates some correlational analysis by extracting principal components from variables based on their correlations, while the I-S correlation uses cointegration analysis to establish the extent of financial integration. The PCA-based measure posits that the proportion of variance explained by the first principal component is an indication of the extent of integration. The higher the proportion, the more financially integrated are the markets or countries. According to Billio *et al.* (2017), the PCA-based measure of financial integration is a more robust measure than the standard correlation coefficient.

From the PCA-presented literature, studies that have used principal component analysis to measure the extent of financial integration find a high comovement of financial assets across countries. Countries covered in the literature include developed and emerging states, Eurozone countries and SACU countries. The comovement is an indication of a rising degree of integration, particularly among countries in the same region. The current article is similar to the study by Aziakpono (2008) who also measures the degree of financial integration among the SACU countries. However, a re-investigation of this concept with an extended sample period to include more recent years is necessitated by continuous financial sector reforms in the member countries and improved linkages across the SACU region.



In addition, the I-S correlation is an indicator based on household decisions and is used to supplement the PCA for measuring financial integration. The I-S correlation postulates that the relationship between domestic investment and domestic saving is an indication of the extent of integration. The lower the association, the higher the degree of integration. The I-S correlation measure is commonly referred to as the Feldstein-Horioka puzzle, because Feldstein and Horioka (1980) interpret the high savings-investment correlation as an indicator of low capital mobility. According to Khan (2017), this interpretation is a puzzle, because there is evidence in the literature of a possibility of a high degree of capital mobility coexisting with highly integrated financial markets, in particular, over the more recent past.

Although researchers such as Mitra (2015) and Khan (2017) have highlighted that it is possible for a high I-S correlation to co-exist with a high degree of capital mobility, the I-S correlation has been widely accepted in the literature as a reliable indicator of the level of international financial integration. Examples include Irandoust (2019), Ginama, Hayakawa and Kanmei (2018), Drakos, Kouretas, Stavroyiannis and Zarangas (2017), Mitra (2015), Kumar (2015), Chen and Shen (2015), Eslamloueyan and Jafari (2014), Johnson and Lamdin (2014), and Di Iorio and Fachin (2014). These studies test the validity of the I-S correlation for several countries, which include European Union countries, Asian countries, African countries, North and South American countries, as well as OECD countries. The main finding is support for the Feldstein-Horioka puzzle where there is a low I-S correlation in highly integrated countries as well as in countries with high international capital flow mobility.

Furthermore, Khan (2017), Chen and Shen (2015), Ketenci (2012) and Guzel and Ozdemir (2011) highlight the necessity of accounting for regime changes or structural breaks when analysing the degree of financial integration using the I-S correlation, because the savings and investment relationship is not constant over time. It goes through a dynamic process as the world markets become more financially integrated. In summary, one of the key findings from the literature above is that the countries are becoming more financially integrated in the most recent sample periods. Also, the I-S correlation is generally lower in the more recent sample periods.

## **2.2. An overview of the Dominance hypothesis literature**

Most of the dominance studies are on German dominance, Euro dominance, China dominance, US dominance and South African dominance. This overview of the dominance literature is divided into sections that look at each of the studies mentioned above.

### **2.2.1. German dominance**

The majority of the international dominance hypothesis literature is of a slightly older vintage and focusses on testing the German dominance hypothesis (GDH) in the European Monetary System (EMS). Booth and Ciner (2005) define the GDH as the unilateral influence of Germany on the other EMS countries, which implies that other EMS countries only respond to changes in German policy but not the reverse. Various studies use market interest rates to test for the dominance hypothesis of an economy. These studies examined whether the German dominance hypothesis holds by determining whether or not German monetary policy influences the monetary policies of other European countries. Traditionally, Granger causality tests and cointegration tests have been used to test the dominance hypothesis.

Looking at the results of previous empirical studies of the GDH, the evidence is mixed. Some authors find evidence (either weak or strong) to support German dominance, while others find no evidence. Karfakis and Moschos (1990) study the interest rate linkages to establish whether or not there exists a long-run trend relationship between Germany and other EMS members. They employ bivariate vector autoregressive analysis and find no evidence of cointegration between the German and each of the other EMS interest rates. However, the authors do a further study using Granger causality tests that highlight the dominant role of Germany in the EMS. They find that German rates Granger cause the interest rates in other EMS members, except for Ireland.

Similarly, Kirchgässner and Wolters (1993) investigate whether or not German interest rates dominate European market rates. However, their analysis involves the Johansen cointegration method, and their results indicate that Germany has a strong position in Europe, and that the long-run German Dominance Hypothesis (GDH) holds.

Furthermore, Hassapis, Pittis, and Prodromidis (1999) test several variations of the GDH, namely Strong German dominance, Semi-Strong German dominance and Weak German dominance. Through a cointegration framework, the authors find evidence of a weak GDH. Hassapis *et al.* (1999) also test the possibility for the dominant player being outside the EMS and conclude that there is some evidence of US dominance in the EMS.

Booth and Ciner (2005) examined the GDH by estimating a VAR-in-levels model and a modified Wald test for money market EMS rates with the USA rate included as a control variable. Because they also found significant feedback effects between Germany and France, their findings display limited evidence of German dominance in the EMS. German dominance was mainly over the Netherlands, Belgium and Denmark. Moreover, Feridun (2006) investigates the existence of the German dominance hypothesis (GDH) among Germany, Slovakia and the Czech Republic, with the United States of America (USA) included as a proxy for the world. The author uses cointegration tests, vector error correction model (VECM) and Granger causality tests to assess the existence of a long-run relationship between the short-term interest rates of these countries. The results indicate support for the GDH, since the Czech and Slovak interest rates share a long-run relationship with German interest rates.

Using cointegration techniques, Reade and Volz (2011:249) investigate the independence of monetary policy of European nations in the period before the EMU. The authors find that Germany is the dominant European country with an independent monetary policy in the union. According to Reade and Volz (2011:249), the monetary policy of the European central banks adjusted to the German policy changes, except for the United Kingdom. However, Von Hagen and Fratianni (1990) reject the hypothesis of complete German dominance of the EMS. They analyse the German dominance and asymmetries in the EMS using a dynamic system of equations explaining national money market interest rates. Von Hagen and Fratianni (1990) find that, although Germany is a relatively strong economy and is the least dependent country within the EMS, they reject the hypothesis of complete German dominance of the EMS.

Katsimbris and Miller (1993) did a further study on the interest-rate linkages within the EMS. The authors also use cointegration tests and Granger causality tests to establish the dominance of Germany within the EMS. Katsimbris and Miller (1993) find evidence of weak cointegration between German interest rates and the other EMS countries' interest rates. The Granger causality tests provide further evidence that Germany is a dominant player within the EMS, since movements in the German interest rate Granger cause the interest rates of the other EMS countries. However, they do not find support for the GDH because there is also evidence of the feedback effects with some EMS countries' interest rates also Granger causing the German rate. Similarly, Camarero and Ordóñez (2001) analyse the hypothesis of German dominance in the EMS for nine European countries. Using the Johansen's maximum likelihood procedure and several tests for parameter instability, Camarero *et al.* (2001) find that although Germany has a significant influence on the monetary policy of the other European countries, the evidence is not strong enough to accept the existence of the German dominance hypothesis.

Laopodis (2004) investigates the GDH by examining the extent to which German short-term interest rates have an influence on future changes in other EMS rates, as well as the extent to which EMS rates influence future changes in the German short-term interest rates. The author uses a multivariate exponential GARCH methodology and finds a significant impact of the German rate on the other EMS rates, both at the conditional mean level and the conditional variance level. However, this is not complete German dominance, as German interest rates are also marginally affected by actions of the other countries, such as France. Moreover, Laopodis (2004) investigates whether or not there are any volatility spillovers between the markets and finds that Germany's conditional variance affects other EMS rates' conditional variances, i.e. strongly and positively for France and weakly and negatively for Belgium and Netherlands.

Janning and Moller (2016) discuss Germany's leadership performance and the more significant role of Germany in the European policy setting, mainly, the foreign and the security policies. According to Janning and Moller (2016), Germany has the resources and capacity to be the European leader, and through analysis, they find that Germany has a significant ability to influence and lead the member states from all regions of

Europe. However, there has been a bit of concern from other European member states who point out that some of the German dominance has harmed the Union in recent years (Janning and Moller, 2016). However, studies such as those by Uctum (1999) and Wang *et al.* (2007) suggest that the formation of the EMU and introduction of the Euro contributed to the decline in the German dominance in Europe.

### **2.2.2. European dominance**

In addition to the GDH literature, a few studies have tested the existence of the European Dominance Hypothesis (EDH), and a few of these studies are highlighted below. Kadow (2007) analyses the integration of the Central and East European (CEE) countries' financial markets using a vector error-correction framework. The author tests for the presence of the EDH by establishing whether or not there is a link between the CEE countries' interest rates and the euro area in the long-run. There is evidence that the European Central Bank influences interest rates in the CEE countries, with Kadow (2007) finding support for the EDH. Likewise, Cerrato, Kadow, MacDonald and Straetmans (2010) test the existence of the EDH for the Central and Eastern European (CEE) countries. They define the EDH as the transmission of the European Central Bank policies to the CEE countries' monetary systems. Their analysis uses a global VAR model, and they find significant transmission of euro area monetary policy to the CEE interest rates, which is evidence of the EDH.

Furthermore, Wang, Yang and Li (2007) examine the contemporaneous and Granger causal linkages among US, Japanese and European interest rates in an attempt to establish whether or not European market rates dominate the US and Japanese interest rates or vice versa. The authors find that the US interest rates have no substantial influence on the European rates while the Japanese interest rates are found to be quite significant as explanatory variables. Wang *et al.* (2007) also find no support for the dominance of the European interest rates on the US and Japanese interest rates. Additional literature explores the EDH by focusing on whether or not the euro is a possible dominant reserve currency, overtaking the US dollar (De la Dehesa, 2009; European Central Bank [ECB], 2017). The main conclusion from the studies is that the euro has the potential to be the dominant global currency, but its international role is quite smaller than that of the US dollar (ECB, 2017).

De la Dehesa (2009) suggests that the international role of the euro can be strengthened by deepening euro-denominated financial markets as well as promoting the use of the euro in payments and as a reserve currency.

### **2.2.3. China and US dominance**

In addition to the GDH and EDH literature, a few more recent studies also tested the existence of the China Dominance Hypothesis (CDH). Chinese dominance mostly focuses on the dominant role of the Chinese currency as a reference or international currency. Fratzscher and Mehl (2011) explore the CDH by investigating whether or not the Chinese renminbi (RMB) is the dominant currency in Asia. They also test whether or not the RMB exerts a considerable influence on exchange rates and monetary policies in the other emerging Asian countries. Using a global factor model of exchange rates and a complementarity event study, they find that the RMB is a crucial driver of currency movements in the Asian economies. However, their results also indicate that developments in China are not wholly exempt from influences from the rest of Asia.

Similarly, Hwang (2015) tests the dominance of China by investigating the dominant role of the renminbi in East Asia. Using regression analysis, the author finds weak evidence of the renminbi dominance but strong evidence of the US dollar dominance. Subramanian and Kessler (2013) address the possibility of the Chinese renminbi (RMB) becoming a premier reference currency, over the US dollar. Through establishing comovements of the RMB with other currencies, Subramanian and Kessler (2013) find that, over time, the average magnitude in currency comovements has increased for the RMB and decreased for the US dollar and the euro. Furthermore, the authors find that the RMB has eclipsed the US dollar and the euro by becoming the dominant reference currency in East Asia and that a *de facto* RMB currency bloc emerged in East Asia.

Likewise, Eichengreen (2011) highlights the potential of the Chinese RMB to emerge as an international currency. Eichengreen (2011) concludes that China has the scope necessary for its RMB to be a global currency, but the country still has to overcome some obstacles to achieve international currency status.

Some of the main obstacles are that China has a relatively small fixed-income market and strong regulation on financial markets. Furthermore, Wu, Pan and Wang (2010) focus on the potential of the RMB to become an international currency. The authors use empirical analysis to explain the potential of the RMB to become a global currency, and they find that there are obstacles that could hinder the rise of the RMB to international currency status. These obstacles include relatively shallow capital markets, restricted access to Chinese capital markets, high transaction costs and weak supervisory and regulatory frameworks between China's capital markets and the international financial system (Wu *et al.*, 2010).

The overall conclusion from the above studies regarding the dominance and role of the Chinese RMB is that the Chinese RMB has become the dominant reference currency in East Asia and is also progressively dominating other countries outside East Asia. These include Chile, India, Israel, and Turkey (Subramanian and Kessler, 2013).

The majority of US dominance studies look at the effect of US variables on the variables in other countries. Kharchenko and Tzvetkov (2013) investigate the existence of spillover effect of stock indices between developed and emerging markets. Through employing a component GARCH model, the authors find evidence of spillovers from the US to China. Moreover, Edwards (2010) explores the US dominance over emerging Latin American and Asian countries by analysing the effects of changes in the US Federal Funds rate on the emerging countries' interest rates. The author finds evidence of a substantial transmission from the Fed Funds rate to Latin American and Asian countries. On the currency front, Eichengreen and Flandreau (2008) provides evidence of the US dollar dominating the pound sterling since the 1930s.

#### **2.2.4. South African dominance**

The studies on South African dominance are most relevant to the current research. Only a few studies have been done to test the South African dominance hypothesis (SADH), and they all find support for the dominance of South Africa on the other SACU countries.

Some of these studies, according to Aziakpono, Kleimeier and Sander (2012:3861), define the SADH as "... the extent to which monetary policy stance in South Africa is passed through and reflected in the monetary policy of the other countries". Sander and Kleimeier (2006), Aziakpono, (2006; 2008), and Burger, Phillipus and Molalapata (2012) have investigated the validity of the SADH through assessing the extent to which South African monetary policy rates affect the monetary policy and market rates in some or all of the other SACU countries by examining the degree of interest rate pass-through amongst the SACU countries.

Using a structural VAR approach, Burger *et al.* (2012) find that the South African monetary policy only dominates the Namibian monetary policy and, therefore, the SADH holds only for Namibia. Furthermore, using cointegration, error correction techniques and impulse-response analysis, Aziakpono (2008) finds that the BLNS countries' financial systems are highly dependent on the South African financial systems. Furthermore, through an empirical pass-through model, Sander and Kleimeier (2006) find that central banks adjust the policy rates to the South African rates; hence, confirming the dominance of South Africa in the Common Monetary Area (CMA).

Some of the studies look at the dominance of South Africa by analysing the effectiveness and convergence of South African macroeconomic variables on the variables of the other SACU countries (Wang, Masha, Shirono and Harris, 2007; Roussow, 2006; Amos, 2010; Zondi, 2012). Using Granger causality tests on inflation, Wang *et al.* (2007) confirm the validity of the SADH for Lesotho and Namibia but not for Swaziland. In the analysis of macroeconomic convergence in the SADC region, Rossouw (2006) confirms that there is a high degree of convergence between CMA countries and that South Africa plays a principal economic role in the SADC region. Similarly, Amos (2010) also looks at the SADC region and focuses on the role of South Africa in the SADC regional integration. According to Amos (2010:124), "South Africa is the most developed and advanced economy in the SADC region and on the continent of Africa", which means that South Africa plays a leading and crucial role in driving economic integration in the SADC region. Zondi (2012) also affirms that South Africa has superior technology, economic resources, and military power, which further cements South Africa's dominant position in the SADC region.



Therefore, the general conclusion of the South African dominance literature is that South Africa is dominant in the Southern African area. South Africa is an essential economic hub in the region with most Southern African countries mostly dependent on her for trade, employment, financial systems and, in some instances, military support. Moreover, Muntschick (2018) shows that South Africa is a key driver in the integration of the SADC region with the European Union. Considering that most of these dominance hypothesis studies are from about a decade ago, the current study adds on to this literature by establishing the current state of the dominance of South Africa.

In conclusion, the common thread in the dominance hypothesis literature discussed above is that these studies focus only on the dominance of the monetary system or currency of a particular country. In comparison to earlier empirical studies, this article aims to extend the analysis of the dominance hypothesis by not only looking at interest rates but also other economic variables such as the fiscal policy variables, inflation, and output.

### **3. METHOD**

This study uses principal component analysis (PCA) and the I-S correlation to assess the extent of financial integration among the SACU countries. PCA is applied to one variable for the panel of five countries at a time, to see whether or not all five countries load onto one common factor. The PCA is one of the popular approaches for determining the degree of financial integration because it is "...valid without needing any specific assumptions regarding the particular distributions of the data except that data used should be on a continuous scale" (Volosovych, 2013:369). Moreover, PCA results are easy to interpret and are robust to outliers. PCA produces principal components that are created by extracting total variance explained by the variables used. For the first principal component, a linear equation obtains the maximum total variance of the variables, and the second principal component creates a second linear combination which extracts maximum (highest possible) remaining variance uncorrelated to the first principal component.

In most cases, the first component captures most of the variation of the original data. In the case of full integration, there will only be one common factor explaining the correlation structure of the country variables. The higher the number of factors explaining the correlations, the lower the degree of financial integration (Aziakpono, 2008). PCA provides eigenvalues and cumulative  $R^2$ , which are used to determine the explanatory power of the first principal component used. Using the Kaiser rule, an eigenvalue that is greater or equal to one denotes a significant principal component. The cumulative  $R^2$  lies between zero and one, and a value close to one indicates high explanatory power of the principal component.

Furthermore, Feldstein and Horioka (1980), who argue that domestic investment should not be related to domestic savings in the face of perfect world capital mobility, proposed the investment-saving (I-S) correlation. Some of the explanations are that if borrowers could borrow from international markets at world rate, they would not need funds from domestic savers, and local savers might not be interested in investing in their own country, but might prefer to lend to foreign investors instead of domestically. The I-S correlation measure is closely related to the interest rate parity conditions in that it assumes complete arbitrage in a perfect world capital market (Feldstein and Horioka, 1980; Aziakpono, 2008). As highlighted in the literature above, financially integrated countries have a low correlation between domestic investment and saving, while a high relationship implies segmented countries.

The I-S correlation proposed by Feldstein and Horioka (1980) is as follows:

$$\frac{I}{Y_{it}} = \alpha + \beta \frac{S}{Y_{it}} \quad (1)$$

where  $\frac{I}{Y_{it}}$  and  $\frac{S}{Y_{it}}$  are the ratios of domestic investment and domestic saving to GDP respectively, in country  $i$  at time  $t$ .  $\alpha$  and  $\beta$  are the parameters to be estimated.  $\beta$  represents the correlation between domestic investment and saving, and its value ranges between zero and one, with zero indicating full integration and one implying no financial integration. Following Aziakpono (2008), this analysis extends Feldstein and Horioka's (1980) proposition of comparing a small country with a big country to the SACU countries, where the value of  $\beta$  is lower for the smaller countries than that of South Africa.

To determine the degree of I-S correlation in each of the SACU countries, the analysis uses the Johansen cointegration technique and a vector error-correction model was used. One of the advantages of the Johansen cointegration and error-correction technique is that it accounts for non-stationarity of variables, and it provides the weak-exogeneity test for determining the endogeneity of the variables used in the model. The variables used for the I-S correlation are domestic investment and savings. This Johansen technique is discussed in detail below, because it is applied to establishing the dominance of South African in the SACU region.

Additionally, to test the validity of the SADH, the analysis tests for the presence of cointegration and error correction mechanisms, explicitly using the Johansen procedure, and the autoregressive distributed lag (ARDL) approach. Traditionally, Granger causality and weak exogeneity tests within a cointegration framework have been used to test the dominance hypothesis (Laopodis, 2004; Kirchgassner and Wolters, 1993; Feridun, 2006). For the dominance hypothesis to hold in the presence of non-stationary data generating processes, cointegration between a South African variable and each of its BLNS counterparts must exist. A further requirement is a one-way causation as assessed using Granger causality and weak exogeneity tests. Therefore, this analysis is used to investigate the validity of the South African dominance hypothesis (SADH) in the SACU region by looking at the extent to which the South African economic variables and policies influence the economic and policy variables of the other SACU countries.

Following Aziakpono (2008), Kadow (2007) and Kirchgässner and Wolters (1993), the SADH will be tested using the Johansen cointegration approach which is a maximum likelihood procedure proposed by Johansen (1988). From the literature discussed above, the test for dominance hypothesis involves testing cointegration on short-term interest rates and exchange rates. That is, monetary aggregates and short-run interest rates have commonly been used to study the reaction of monetary authorities to monetary innovations coming from other countries (Feridun, 2006:175).

However, for the test of the South African dominance hypothesis, this article will extend the scope of the variables to include the following: discount rates, deposit rates, lending rates, Treasury bill rate, real interest rates (long-term and short-term), consumer price index/inflation, gross domestic product (output), the budget deficit, government revenue and expenditure, and public debt.

The Johansen procedure is used to establish the presence of cointegrating relationships in a system of variables. This analysis will be in a bivariate framework involving a South African variable and one of its BLNS counterparts at a time, which means that the number of cointegrating relationships can be 0 or 1, given a bivariate setup. This approach is similar to that followed by Aziakpono (2008) and Wang *et al.* (2007). Since the standard Johansen procedure requires that all the variables in the system be integrated of order one,<sup>8</sup> i.e.  $I(1)$ , the first step would be unit root testing to establish the order of integration of the South African and other SACU countries' variables. The article uses the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity tests because, compared to other traditional unit root tests (augmented Dickey-Fuller, Phillips-Peron and DF-GLS tests), it has more statistical power. If all the series are found to be non-stationary or  $I(1)$ , the next step is to test for cointegration.

Out of several methods<sup>9</sup> of cointegration testing that are available, the Johansen procedure has desirable characteristics which include (Gonzalo, 1994:224; Gulzar, Feng and Yajje, 2007:667):

- The incorporation of all prior knowledge about the presence of unit root tests purges the median bias and non-symmetry and increases efficiency.
- The procedure is a full-system estimation, which eliminates the simultaneous equation bias.
- It is flexible enough to capture the dynamics of the system.
- The Johansen procedure gives the most consistent and accurate results of cointegration.

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<sup>8</sup> Note that the Johansen procedure can also be run with  $I(2)$  variables, but this is not considered at present for this study.

<sup>9</sup> These include the Johansen cointegration technique by Johansen (1988), ordinary least squares (OLS) by Engle and Granger (1987), nonlinear least squares (NLS) by Stock (1987), principal components (PC) by Stock and Watson (1988) and the canonical correlations (CC) method by Bossaerts (1988) (Gonzalo, 1994: 203).

The test for cointegration will start with the estimation of an unrestricted vector autoregression model (VAR) to test for lag length; then use the Johansen cointegration test to establish whether or not a long-run relationship exists among the variables at the chosen lag length. If a relationship exists, a vector error correction model (VECM) is specified. Several information criteria statistics will be used for selecting the appropriate lag length. These include the sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). The Johansen procedure uses the Trace test to establish the number of cointegrating vectors (usually denoted  $r$ ).

In the presence of cointegration, a VECM is specified, and the parameters of interest estimated. The VECM estimates parameters of the cointegrating vector(s) that are given economic meaning by normalising on the endogenous variables in the model (Choudhry, 1998:365). The VECM also looks into the short-term dynamics of the variables in the system through the estimation of the error correction term. The error correction term implies that the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The VEC representation to be estimated is given by equation (2) as specified in Johansen and Juselius (1990):

$$\Delta X_{it} = \Pi X_{it-1} + \Sigma \Gamma_k \Delta X_{it-k} + \varepsilon_t \quad (2)$$

where  $X_{it}$  represents an  $m \times 1$  vector consisting of the  $I(1)$  country variables,  $\Gamma_k$  represents short-run coefficients,  $\varepsilon_t$  represents the stochastic error terms and  $k$  is the lag length selected.  $\Pi$  represents a coefficient matrix,  $\alpha\beta'$ . The elements of the  $\alpha$  matrix are the adjustment coefficients, i.e. error correction terms, which describe the speed of adjustments to the long-run equilibrium so that in equilibrium the error correction terms are equal to zero (Cerrato *et al.*, 2010). The elements of the  $\beta$  matrix are the long-run coefficients.

Following Kirchgassner *et al.* (1993), Aziakpono (2008) and Cerrato *et al.* (2010), the SADH will be implied by evidence of the dependence of the BLNS variables on South African variables. The existence of cointegration between South African variables and the BLNS countries' variables indicates this dependence.

The long-run equations of the BLNS countries include the South African variables as right-hand side variables and the long-run coefficient, i.e.  $\beta$  parameters, show the effect of the South African variables on the BLNS countries. A high (close to 1) and significant long-run coefficient of the South African variable will mean that the BLNS variables respond significantly to changes in South African variables. The Johansen technique also involves the use of the weak exogeneity test as well as the impulse-response functions. The weak exogeneity test establishes whether or not the country variables are weakly exogenous in the long-run relationship (i.e.  $\beta$  parameters). In other words, the test establishes whether or not the variable in question responds to a deviation from the long-run equilibrium relationship.

Following Aziakpono (2008), and Luintel and Khan (1999), this thesis uses a weak exogeneity test in a VECM framework to determine whether or not there is long-run causality between the South African variable and the BLNS variable. The null hypothesis for the weak exogeneity test is that the variable is weakly exogenous, i.e. the variable does not respond significantly to changes in other variables. In the bivariate relationships being tested, a finding that the BLNS variables are not weakly exogenous serves as an indication that the SA variable does cause the BLNS variable in the long run. However, a finding that both variables are weakly exogenous implies that there is an independent relationship between the two variables (Johansen, 1992). Furthermore, the SADH is taken to exist if long-run causality is found to be running only from the SA variable to BLNS variables. In other words, for the SADH to hold, the South African variables should be weakly exogenous with respect to the variables of the BLNS countries.

Once cointegration is established, the next step involves estimating the long-run and error correction coefficients of the cointegration equation. The estimation of the error correction terms gives rise to a question of how long it takes for the economy to adjust back to its equilibrium after a shock or a disturbance. A half-life indicator addresses this question and is a measure of the speed of convergence. The half-life indicator is calculated as (Burger and Janse van Rensburg, 2008):

$$\frac{\ln(0.5)}{\ln(1 + \rho)}$$

where  $\rho$  is the error correction term.

Other than the Johansen approach, if a series is stationary or if a pair of variables is non-cointegrated, the Granger causality testing is applied to determine whether or not there is the short-run causality. According to Aziakpono (2008) and Demetriades and Hussein (1996), the standard Granger causality tests are run on stationary series, while for non-stationary and non-cointegrated series, the Granger causality test is run on first differences of the non-stationary series. Similar to the weak exogeneity test, the Granger causality test findings indicate the existence of the SADH if causality is found to be running only from the SA variable to BLNS variables.

Furthermore, given that the fiscal variables and GDP are only available on an annual basis, this poses a problem of small sample sizes. Hence, the analysis uses panel unit root and cointegration methods, which allow for short sample periods, to test for the cointegration of some of the country variables (Örsal, 2007). One of the advantages of using panel data is that it "...provides the researcher with a larger data set and, consequently, additional information and increased degrees of freedom, which could be important in reducing collinearity among the explanatory variables" (Ozanne, 2006: 3). There are several unit root tests that can be used which include the Breitung (2000) test; the Choi (2001) test; the Levin, Lin and Chu (2002) test (LLC); the Im, Pesaran and Shin (2003) test (IPS); the Hadri (2000) test; and the Fisher-type tests (Maddala and Wu, 1999; Choi, 2001). For the SACU countries, this study uses the IPS test, the Fisher-ADF, and the Fisher-PP tests because they test for individual unit root processes.

Following unit root analysis, panel cointegration is tested using the Kao (1999) cointegration test, which is Engle-Granger based, as well as the Fisher cointegration test, which is a form of the Johansen method. The EG method involves an examination of the residuals of a spurious regression performed using  $I(1)$  variables. If the variables are cointegrated, the residuals should be  $I(0)$ , while if the variables are not cointegrated, the residuals will be  $I(1)$ . Kao (1999) extends the EG framework using both DF and ADF to test for cointegration in panel data. Moreover, the Johansen Fisher cointegration test was proposed by Maddala and Wu (1999) and is a combined test that uses the results of the individual independent tests to obtain a test-statistic for the full panel.

These authors use Fisher's result to propose an alternative approach to testing for cointegration. The null hypothesis for this cointegration is that there is no cointegration.

In addition, panel causality tests were used for the non-cointegrated, but stationary series. The panel causality tests used are the standard Granger causality test and the Dumitrescu-Hurlin (2012) causality test. The standard Granger causality test treats the panel data as one large stacked data and assumes homogeneity across all countries included in the panel (EViews 9 Users' guide II: 926). Conversely, the Dumitrescu-Hurlin (2012) method assumes and accounts for differences across countries. The null hypotheses for both these tests are that there is no causality between the variables. The finding that only the SA variable does cause the BLNS variable and not the other way around implies the presence of the SADH in the SACU region.

#### **4. DATA AND RESULTS**

The estimation results reported below are based on the data for South Africa (SA), Botswana (B), Lesotho (L), Namibia (N) and Swaziland (S). Tables 2a and 2b present the frequency and dates available for the data. For this study, the proxies for the short-term interest rate are the deposit rate and the discount rate, the lending rate represents the long-term interest rate, and Gross Domestic Product (GDP) is the output variable. The nominal interest rates and inflation rates are used to construct real short-term and long-term rates.

The real rate was calculated as follows:

$$r = \frac{i - \pi}{1 + \pi} \text{ [from } (1 + i) = (1 + r)(1 + \pi)\text{]}$$

where:  $r$  = real rate;  $i$  = nominal interest rate (deposit and TB rate for short-term and lending rate for long-term) and  $\pi$  = inflation rate.



Table 2a: Interest rate variables (monthly)

Variable	Country	sample size
<b>NOMINAL RATES</b>		
<b>Deposit rate</b>	<b>B, S &amp; SA</b>	444
	<b>L</b>	381
	<b>N</b>	312
<b>Lending rate</b>	<b>B, L, S &amp; SA</b>	444
	<b>N</b>	312
<b>Discount rate</b>	<b>B, L, S &amp; SA</b>	444
	<b>N</b>	304
<b>TB rate</b>	<b>L</b>	442
	<b>N</b>	301
	<b>S</b>	421
	<b>SA</b>	443
<b>REAL RATES</b>		
<b>Deposit rate</b>	<b>B, L, S, SA</b>	443
	<b>N</b>	179
<b>Discount rate</b>	<b>B, S, SA</b>	443
	<b>L, N</b>	179
<b>Lending rate</b>	<b>B</b>	443
	<b>L, N</b>	179
	<b>S, SA</b>	443

Tables 2a and 2b above show that monthly data range from January 1980 to December 2016 for monthly data and annual data range from 1960 to 2015, although this varies depending on the country. The data originate from Quantec, the International Monetary Fund International Financial Statistics (IMF IFS), Quandl, the World Bank Databank, and the Knoema database. All analysis was carried out using E-views 9. Some of the annual series are short, which makes for a small sample size. Therefore, it is more plausible to use a panel setting for annual data. However, for measuring the extent of financial integration among the SACU countries, bivariate I-S correlation models are estimated for each country, not in a panel setup.

The extent or degree of financial, monetary and economic integration in the SACU region suggests that there could be significant spillovers across the countries. Consequently, the main contribution of this article is to test the validity of the SADH based on causality, cointegration and exogeneity tests using bivariate VAR systems.

Table 2b: Economic policy variables

Variable	Country	sample size
<b>MONETARY POLICY</b>		
<b>Inflation (M)</b>	<b>B</b>	443
	<b>L</b>	179
	<b>N</b>	179
	<b>S</b>	443
	<b>SA</b>	443
<b>GDP (Q)</b>	<b>B</b>	92
	<b>SA</b>	228
<b>GDP (A)</b>	<b>B</b>	52
	<b>L</b>	51
	<b>N</b>	31
	<b>S</b>	50
	<b>SA</b>	56
<b>Domestic saving*</b>	<b>B</b>	56
	<b>N</b>	38
	<b>S</b>	56
	<b>SA</b>	56
<b>Domestic investment</b>	<b>B</b>	56
	<b>L</b>	56
	<b>N</b>	38
	<b>S</b>	56
	<b>SA</b>	56
<b>FISCAL POLICY (A)</b>		
<b>Debt</b>	<b>B</b>	44
	<b>L</b>	43
	<b>N</b>	22
	<b>S</b>	46
	<b>SA</b>	56
<b>Government expenditure</b>	<b>B</b>	56
	<b>L</b>	56
	<b>N</b>	36
	<b>S</b>	56
	<b>SA</b>	56
<b>Primary balance</b>	<b>S</b>	35
	<b>SA</b>	55

Note: 1. M = monthly data; Q = quarterly data; A = annual data; 2. \* denotes that Lesotho data has missing data for years 1982 – 2006 and is, therefore, excluded from the analysis

#### 4.1. Financial integration analysis

The principal component analysis (PCA) and the I-S correlation measures were used to investigate the degree of financial integration. The PCA is applied to the interest rates (deposit, discount, lending, treasury bill, savings), inflation, GDP, government expenditure and debt, one variable at a time for a panel of the SACU countries. The data is spilt over five-year non-overlapping sample periods to explore the dynamics of integration over time and ascertain whether or not there is a change in financial integration over time. However, the last sample period has seven years to accommodate the observations from the remaining two years.

Table 3a: Principal component analysis results (Interest rates)

Variable	Sample period	1 <sup>st</sup> Eigenvalue	2 <sup>nd</sup> Eigenvalue	Cum $R^2$
Discount rate	1991 - 2016	4.084	0.655	0.817
	1991 - 1994	4.049	0.736	0.810
	1995 - 1999	3.048	0.973	0.821
	2000 - 2004	3.519	1.059	0.704
	2005 - 2009	3.560	0.980	0.812
	2010 - 2016	3.750	0.919	0.850
Deposit rate	1991 - 2016	4.355	0.468	0.871
	1991 - 1994	3.709	0.902	0.742
	1995 - 1999	2.994	1.372	0.799
	2000 - 2004	3.679	0.867	0.836
	2005 - 2009	3.800	1.067	0.860
	2010 - 2016	2.512	0.916	0.902
Lending rate	1991 - 2016	4.087	0.746	0.818
	1991 - 1994	4.161	0.505	0.832
	1995 - 1999	3.473	0.986	0.695
	2000 - 2004	3.826	0.903	0.765
	2005 - 2009	4.178	0.720	0.836
	2010 - 2016	3.973	0.825	0.895
TB rate**	1991 - 2016	3.815	0.132	0.954
	1991 - 1994	3.717	0.217	0.929
	1995 - 1999	3.357	0.542	0.839
	2000 - 2004	3.154	0.517	0.788
	2005 - 2009	3.759	0.136	0.840
	2010 - 2016	3.235	0.587	0.909
Savings rate*	2000 - 2016	2.614	0.791	0.653
	2000 - 2004	2.185	0.917	0.546
	2005 - 2009	2.637	0.821	0.659
	2010 - 2016	2.352	0.7.04	0.788

Note: 1. \* - the group of countries excludes Namibia; 2. \*\* - the group of countries excludes Botswana

The results reported in Table 3a indicate that, over the whole sample period, all the interest rates have only one significant principal component with an eigenvalue greater than one as well as a cumulative  $R^2$  of above 0.6. However, after splitting the sample into smaller periods, there are some periods where the discount rate (2000 – 2004) and deposit rate (1995 – 1999; 2005 – 2009) have two principal components with an eigenvalue greater than 1. However, the relative contributions of the second principal components in those sample periods to total variances are low (range from 0.201 – 0.275) because they are close to zero.

The implication is that SACU countries are highly financially integrated with strong evidence of comovement among the interest rates. The PCA results of economic and fiscal policy variables in Table 3b show that inflation and GDP have one significant principal component for the SACU countries, indicating significant comovement among these economic variables. However, the fiscal policy variables produce two significant principal components. The proportions of the variance explained by the first principal components are less than 50% for both government expenditure and debt. Furthermore, from splitting data into smaller samples, the eigenvalues and the cumulative  $R^2$  for the first principal components show that the degree of financial integration has improved with time.

Table 3b: Principal component analysis results (Economic and fiscal policy variables)

Variable	Sample	1 <sup>st</sup> Eigenvalue	2 <sup>nd</sup> Eigenvalue	Cum $R^2$
<b>Inflation</b>	2003 - 2016	3.618	0.742	0.724
	2003 - 2007	3.279	0.852	0.656
	2008 - 2012	4.202	0.437	0.841
	2013 - 2016	3.296	0.594	0.859
<b>GDP</b>	1980 - 2017	4.841	0.141	0.968
<b>GDP*</b>	1970 - 2017	3.917	0.065	0.979
<b>Government expenditure</b>	1977 - 2017	2.333	1.794	0.467
<b>Government expenditure*</b>	1960 - 2017	1.654	1.168	0.414
<b>Debt</b>	1990 - 2017	1.881	1.373	0.376
<b>Debt*</b>	1970 - 2017	1.713	1.328	0.428

Note: \* - the group of countries excludes Namibia

For the I-S correlation, the analysis of the unit root tests of the time series indicated that the order of integration of the saving and investment variables ranges from  $I(0)$  to  $I(1)$  and varies from country to country.

Table 4 presents the results of the unit root analysis. These results indicate that domestic savings, and domestic investment for all countries are non-stationary.

Table 4: KPSS unit root analysis for I-S variables

Variable	Country	Level	1st difference	Conclusion
Saving	B	0.642	0.280	I(1)
	N	0.638	0.195	I(1)
	S	0.602	0.048	I(1)
	SA	0.752	0.125	I(1)
Investment	B	0.759	0.119	I(1)
	N	0.597	0.139	I(1)
	S	0.589	0.140	I(1)
	SA	0.480	0.125	I(1)

Note: KPSS 5% critical value is 0.463.

Pairing investment and saving per country, all countries have I(1) variables and can therefore be tested for cointegration using the Johansen technique. Thus Table 5 presents the results of the cointegration analysis for all four countries. There is evidence of cointegration for all four countries. Table 6 depicts the results of the vector-error correction models (VECM), weak exogeneity analysis and residual diagnostics for the I-S correlation. The trace statistic and maximum eigenvalue results show that all pairs of variables in the models are cointegrated.

Table 5: Johansen cointegration results (I-S correlation)

Country	VEC Lag	Deterministic trend assumption	r	Trace (p-value)	Max (p-value)	Conclusion
B	2	Intercept in CE & no intercept in VAR	1	20.918 (0.041)	17.240 (0.043)	Y
			2	5.678 (0.217)	5.678 (0.217)	
N	2	Intercept in CE & in VAR	1	16.359 (0.037)	12.891 (0.082)	Y
			2	3.468 (0.063)	3.468 (0.063)	
S	2	Intercept in CE & in VAR	1	17.278 (0.027)	14.868 (0.040)	Y
			2	2.409 (0.121)	2.409 (0.121)	
SA	2	Intercept in CE & in VAR	1	16.508 (0.035)	15.747 (0.029)	Y
			2	0.761 (0.383)	0.761 (0.383)	

Note: 1. CE = cointegrating equation; 2. r = number of cointegrating relations; 3. Y = reject the null hypothesis of no cointegration at 5% significance level

The weak exogeneity results show that investment is endogenous for Botswana, Swaziland and South Africa, and exogenous for Namibia, while savings is exogenous for Botswana, Swaziland and South Africa and endogenous for Namibia. The implication of the weak exogeneity results is that the VECM normalises on investment for Botswana, Swaziland and South Africa and on savings for Namibia.

Therefore, considering that the I-S correlation expresses investment as a function of savings, the subsequent analysis excludes Namibia because savings are endogenous and not investment.

Table 6: VECM results (I-S correlation)

Country	WE (I)	WE (S)	LR coefficient	ECT	LM test	Portmanteau test	Heteroskedasticity
<b>B</b>	6.889	2.040	-0.412	-0.187	1.913	5.118	20.343
	<i>0.009</i>	<i>0.153</i>	[2.063]	[-2.985]	<i>0.752</i>	<i>0.646</i>	<i>0.314</i>
<b>S</b>	12.355	0.032	0.465	-0.322	4.468	8.372	63.488
	<i>0.000</i>	<i>0.858</i>	[3.003]	[-3.700]	<i>0.346</i>	<i>0.212</i>	<i>0.177</i>
<b>SA</b>	13.321	0.001	0.826	-0.436	2.540	2.503	36.411
	<i>0.000</i>	<i>0.974</i>	[8.400]	[-3.767]	<i>0.638</i>	<i>0.868</i>	<i>0.195</i>

Notes: 1. The values in square brackets are the t-statistics, and the values in italics are the p-values; 2. Only the cointegrated relationships are reported; 3. "WE" is the weak exogeneity test. WE (S) means the savings variable is being tested for weak exogeneity and WE(I) means the investment variable is being tested; 4. The LM and the Portmanteau tests are tested at the same lag as the VECM

The long-run coefficient represents the correlation ( $\beta$ ) between investment and savings. All the coefficients are statistically significant and are between 0 and 1 as expected. Botswana has the lowest coefficient (in absolute terms) of -0.412, followed by Swaziland (0.465) and South Africa with a coefficient of 0.825. This implies that Botswana and Swaziland are financially more integrated than South Africa. These results are consistent with those of Aziakpono (2008) who found a higher I-S coefficient for South Africa compared to the other SACU countries. The value of 0.825 for South Africa is an indication of a low level of integration. However, it is slightly lower than that found by Aziakpono (2008) of 0.9 with data up to 2005. Therefore, this slight difference could be attributed to South Africa becoming increasingly integrated into the world during the last 15 years. In summary, the PCA and I-S correlation results show that the SACU countries are financially integrated, with the PCA results further indicating that the degree of integration improved in the most recent years.

#### **4.2. Cointegration analysis for the SADH**

The analysis of the unit root tests of the time series indicates that the order of integration of the variables ranges from I(0) to I(1) and varies from country to country. Tables 7a and 7b present the results of the unit root analysis.

Table 7a: KPSS unit root analysis for interest rates

Variable	Country	Level	1st difference	Conclusion
<b>NOMINAL INTEREST RATES</b>				
<b>Deposit rate</b>	<b>B</b>	0,897	0,281	I(1)
	<b>L</b>	1,870	0,071	I(1)
	<b>N</b>	1,615	0,075	I(1)
	<b>S</b>	1,316	0,094	I(1)
	<b>SA</b>	1,255	0,129	I(1)
<b>Lending rate</b>	<b>B</b>	0,504	0,063	I(1)
	<b>L</b>	0,989	0,096	I(1)
	<b>N</b>	1,946	0,141	I(1)
	<b>S</b>	1,062	0,113	I(1)
	<b>SA</b>	1,335	0,119	I(1)
<b>Discount rate</b>	<b>B</b>	0,583	0,411	I(1)
	<b>L</b>	0,544	0,126	I(1)
	<b>N</b>	1,851	0,103	I(1)
	<b>S</b>	1,182	0,096	I(1)
	<b>SA</b>	1,324	0,150	I(1)
<b>TB rate</b>	<b>L</b>	1,348	0,126	I(1)
	<b>N</b>	1,641	0,087	I(1)
	<b>S</b>	1,151	0,030	I(1)
	<b>SA</b>	1,309	0,130	I(1)
<b>REAL INTEREST RATES</b>				
<b>Short real interest rate (deposit rate)</b>	<b>B</b>	0,904	0,283	I(1)
	<b>L</b>	0,980	0,116	I(1)
	<b>N</b>	1,053	0,084	I(1)
	<b>S</b>	1,323	0,094	I(1)
	<b>SA</b>	1,264	0,130	I(1)
	<b>SA (shorter sample)</b>	0,591	0,082	I(1)
<b>Short real interest rate (Discount rate)</b>	<b>B</b>	0,583	0,421	I(1)
	<b>L</b>	1,227	0,068	I(1)
	<b>N</b>	0,941	0,071	I(1)
	<b>S</b>	1,184	0,095	I(1)
	<b>SA</b>	1,337	0,150	I(1)
	<b>SA (shorter sample)</b>	0,921	0,076	I(1)
<b>Long real interest rate (Lending rate)</b>	<b>B</b>	0,505	0,103	I(1)
	<b>L</b>	0,919	0,111	I(1)
	<b>N</b>	1,079	0,074	I(1)
	<b>S</b>	1,063	0,111	I(1)
	<b>SA</b>	1,339	0,120	I(1)
	<b>SA (shorter sample)</b>	0,922	0,076	I(1)

Note: 5% critical value is 0.463.

The results show that there are a few stationary series, and these are Lesotho and Namibia inflation rates, Lesotho, Swaziland and South African debt variables, government expenditure series of Botswana, Namibia and Swaziland, Swaziland primary balance, Namibian domestic saving as well as Botswana domestic investment. All other variables are I(1).

Table 7b: KPSS unit root analysis for economic policy variables

Variable	Country	Level	1st difference	Conclusion
<b>MONETARY POLICY</b>				
<b>Inflation</b>	<b>B</b>	1,489	0,177	I(1)
	<b>L</b>	0,256	-	I(0)
	<b>N</b>	0,145	-	I(0)
	<b>S</b>	2,014	0,134	I(1)
	<b>SA</b>	2,060	0,064	I(1)
	<b>SA (shorter sample)</b>	0,084	-	I(0)
<b>GDP (Q)</b>	<b>B</b>	1,248	0,191	I(1)
	<b>SA</b>	1,245	0,312	I(1)
<b>GDP (A)</b>	<b>B</b>	0,995	0,290	I(1)
	<b>L</b>	0,947	0,193	I(1)
	<b>N</b>	0,777	0,322	I(1)
	<b>S</b>	0,934	0,233	I(1)
	<b>SA</b>	0,903	0,297	I(1)
<b>FISCAL POLICY</b>				
<b>Debt</b>	<b>B</b>	0,606	0,113	I(1)
	<b>L</b>	0,290	-	I(0)
	<b>N</b>	-	-	-
	<b>S</b>	0,164	-	I(0)
	<b>SA</b>	0,173	-	I(0)
<b>Government expenditure</b>	<b>B</b>	0,154	-	I(0)
	<b>L</b>	0,783	0,205	I(1)
	<b>N</b>	0,230	-	I(0)
	<b>S</b>	0,265	-	I(0)
	<b>SA</b>	0,815	0,239	I(1)
<b>Primary balance</b>	<b>S</b>	0,139	-	I(0)
	<b>SA</b>	0,496	0,401	I(1)

Note: 1. 5% critical value is 0,463; 2. SA (shorter sample) represents a shortened sample in comparison to Lesotho and Namibia shorter inflation series

Because of the small sample size problem, panel unit root analysis was done for annual variables, and Table 7c presents the results. The results show that GDP and government expenditure are I(1), while debt is I(0).



Table 7c: Panel unit root analysis for annual data

Variable		LLC	IPS	Fisher ADF	Conclusion
GDP	Level	-1,466 (0,071)	2,330 (0,990)	1,950 (0,983)	I(1)
	1st difference	-6,749 (0,000)	-7,147 (0,000)	61,384 (0,000)	
Debt	Level	-1,6897 (0,045)	-2,254 (0,012)	17,477 (0,026)	I(0)
Government expenditure	Level	-0,523 (0,301)	-1,175 (0,120)	12,659 (0,124)	I(1)
	1st difference	-8,169 (0,000)	-9,236 (0,000)	87,341 (0,000)	

Note: 1. 5% significance level used; 2. Numbers in parentheses are p-values

Following the results of the unit root tests, cointegration analysis was done to establish whether or not there is a cointegrating relationship between the variables. Because some of the series are stationary while some are non-stationary, bivariate cointegration analysis was used on pairs consisting of non-stationary series. Tables 8 and 9 display the Johansen cointegration results. The tables report the optimal lag selected for the VECM, the Trace statistic and p-value, the applicable deterministic trend assumptions, the long-run and short-run coefficients, the half-life measures, the weak exogeneity test results as well as the residual diagnostic tests. The lag order of the VAR models was chosen using the Schwarz information criterion, the Sequential modified likelihood ratio, the Final prediction error, the Akaike information criterion, and the Hannan-Quinn information criterion depending on which one produced a meaningful cointegration relation.

The Johansen trace test results presented in Table 8 show that some of the paired series were cointegrated. These are the deposit rates, TB rates, lending rates and real long-term rates for Lesotho, Namibia, and Swaziland (LNS), as well as the discount rates for Lesotho and Swaziland. However, none of the Botswana rates are cointegrated with SA rates. In addition, none of the short-term real rates are cointegrated with SA short-term real rates except for the Swaziland short-term real rates. In the results, we also present the LM and the Portmanteau test statistics as diagnostic checks for the presence of serial correlation and auto-correlation to confirm the appropriateness of the cointegrating models being reported. These tests show that the estimated cointegrating equations do not suffer from serial correlation and auto-correlation.

Table 8: Johansen cointegration results (SADH)

Variable	Country	VEC Lag	Trace statistic	Trace p-value	Conclusion
Inflation rate	B	2	166,623	0,000	Y
Deposit rate	B	3	11,086	0,206	N
	L	1	17,806	0,022	Y
	N	2	23,745	0,002	Y
	S	1	15,634	0,048	Y
Discount rate	B	2	13,789	0,132	N
	L	4	24,483	0,002	Y
	S	3	20,746	0,007	Y
TB rate	L	1	37,696	0,000	Y
	N	1	29,435	0,000	Y
	S	2	20,154	0,009	Y
Lending rate	B	2	15,310	0,209	N
	L	2	25,398	0,001	Y
	N	5	28,103	0,000	Y
	S	4	17,488	0,025	Y
Short-term real interest rate (Deposit rate)	B	3	11,215	0,199	N
	L	3	6,423	0,646	N
	N	4	7,860	0,481	N
	S	1	16,224	0,039	Y
Short-term real interest rate (Discount rate)	B	3	15,108	0,220	N
	L	3	15,741	0,187	N
	N	2	17,832	0,104	N
	S	3	21,219	0,006	Y
Long-term real interest rate	B	2	15,514	0,198	N
	L	6	45,062	0,000	Y
	N	5	16,418	0,036	Y
	S	2	21,586	0,005	Y

Note: 1. The cointegration option 3 used for all testing and it includes an intercept in the cointegrating equation and the VAR; 2. The significance level used is 5% and the test statistic reported is for the null hypothesis of no cointegrating equations; 3. Y - indicates the presence of cointegration and N indicates no cointegration

The VECM results in Tables 9a and 9b indicate that the cointegrating parameters of the bivariate analyses between SA variables and each of the BLNS variables fall within the expected magnitude of between 0 and 1 except for the bivariate analysis between Namibian and South African TB rates. However, as much as this coefficient exceeds 1, a test to determine whether or not this coefficient is statistically different from 1 indicated that the coefficient is statistically not different from 1. The results indicate that the long-run coefficients of the nominal interest rates range from 0.521 to 1.032. These long-run coefficients mean that if South African interest rates changed by 1%, in the long-run, other country interest rates also adjust, *ceteris paribus*, by magnitudes ranging between 0.52% and 1%.

With the exception of Botswana nominal rates, lending rates for Lesotho and Swaziland appear to have the lowest response to changes in the SA rates. As reported in Table 8b, Namibian long-term real interest rate has the highest average long-run coefficient of 0.97, followed by Lesotho long-term real interest rate with a coefficient of 0.92 and lastly, Swaziland short-term real interest rate with a coefficient of 0.89. These high and significant long-run coefficients for the LNS countries could be explained by the high dependence of these economies on South Africa and, in particular, their membership in the CMA. Therefore, the above bivariate cointegration analysis shows that there is evidence of the dependence of the BLNS countries on South Africa for most economic variables.

In addition to the long-run coefficients, Tables 9a and 9b also report the error correction terms. All the estimated short-run coefficients have the expected negative sign and magnitudes between 0 and -1, while also being statistically significant. The significant error correction terms imply that, in the presence of a disturbance, a particular variable adjusts to movements from its long-run relationship. Moreover, the size of an error correction term represents the speed of adjustment of the variable towards its long-run equilibrium (Aziakpono, 2006).

Table 9a: VECM results for nominal interest rates (SADH)

Variables	Country	LR coefficient	ECT	Half-life	LM test	Portmanteau test	WE (SA)	WE (BLNS)
Deposit rate	L	0,956	-0,054	12,486	6.862	5,914	2,443	5,709
		[9,786]	[-2,747]		<i>0,134</i>	<i>0,501</i>	<i>0,118</i>	<i>0,017</i>
	N	0,853	-0,046	14,719	7,726	8,693	2,863	4,524
		[19,243]	[-2,283]		<i>0,102</i>	<i>0,192</i>	<i>0,103</i>	<i>0,033</i>
	S	0,907	-0,028	24,407	4,331	5,393	2,339	4,258
		[7,610]	[-2,447]		<i>0,363</i>	<i>0,495</i>	<i>0,126</i>	<i>0,039</i>
Discount rate	L	0,524	-0,068	9,843	8,159	10,147	2,460	6,981
		[4,894]	[-3,591]		<i>0,086</i>	<i>0,119</i>	<i>0,117</i>	<i>0,008</i>
	S	0,907	-0,054	12,486	8,200	9,075	0,431	6,475
		[11,594]	[-3,343]		<i>0,085</i>	<i>0,169</i>	<i>0,511</i>	<i>0,011</i>
TB rate	L	0,980	-0,105	6,248	1,356	1,633	3,580	23,014
		[15,483]	[-5,177]		<i>0,852</i>	<i>0,950</i>	<i>0,058</i>	<i>0,000</i>
	N	1,028	-0,108	6,065	4,943	4,579	1,416	4,416
		[36,226]	[-2,381]		<i>0,293</i>	<i>0,599</i>	<i>0,234</i>	<i>0,036</i>
	S	0,699	-0,060	11,251	5,763	6,348	0,401	6,246
		[7,167]	[-3,590]		<i>0,218</i>	<i>0,385</i>	<i>0,527</i>	<i>0,012</i>
Lending rate	L	0,730	-0,131	4,937	7,459	5,674	0,659	12,404
		[11,712]	[-4,369]		<i>0,114</i>	<i>0,578</i>	<i>0,417</i>	<i>0,000</i>
	N	1,032	-0,116	5,622	2,396	3,298	4,261	10,028
		[21,262]	[-3,694]		<i>0,663</i>	<i>0,771</i>	<i>0,039</i>	<i>0,002</i>
	S	0,521	-0,036	18,905	3,006	3,771	0,348	1,050
		[4,093]	[-2,683]		<i>0,557</i>	<i>0,708</i>	<i>0,555</i>	<i>0,306</i>

Notes: 1. The values in square brackets are the t-statistics and the values in italics are the p-values. The 5% critical value for the t-statistic is 1.645; 2. Only the cointegrated relationships are reported; 3. "WE" is the weak exogeneity test. WE (SA) means the SA variable is being tested for weak exogeneity; 4. The LM and the Portmanteau tests are tested at the same lag as the VECM.

The results indicate different magnitudes of the error correction terms for the cointegrated pairs, which implies that the speeds of adjustment vary between countries. The discussion of these error correction terms is in conjunction with their corresponding half-life measures. The error correction terms for the cointegrated interest rates range from -0.028 to -0.528, with half-life measure ranging from 0.51 to 24.41 months. These magnitudes of the error correction terms mean that between 2.8 and 52.8 percent of the deviations of interest rates from the long-run relationship is corrected in one month for the LNS countries. The highest adjustment parameters for the LNS countries are all from cointegrating relationships of long-term real interest rates with values of 52.8%, 12.2% and 7.8% respectively.

Table 9b: VECM results for inflation rate and real interest rates (SADH)

Variables	Country	LR coefficient	ECT	Half-life	LM test	Portman-teau test	WE (SA)	WE (BLNS)
Inflation	B	0,585	-0,744	0,509	7,354	10,056	3,135	74,322
		[7,79]	<i>[-11,16]</i>		<i>0,123</i>	<i>0,129</i>	<i>0,177</i>	<i>0,000</i>
Short-term real interest rate (deposit rate)	S	0,908	-0,040	17,111	8,325	9,785	1,800	5,769
		[7,93]	<i>[-2,76]</i>		<i>0,114</i>	<i>0,134</i>	<i>0,180</i>	<i>0,016</i>
Short-term real interest rate (discount rate)	S	0,885	-0,078	8,535	6,038	6,502	0,334	7,800
		[11,99]	<i>[-3,60]</i>		<i>0,196</i>	<i>0,369</i>	<i>0,564</i>	<i>0,005</i>
Long-term real interest rate	L	0,924	-0,528	0,923	1,234	10,348	0,035	17,829
		[96,92]	<i>[4,50]</i>		<i>0,872</i>	<i>0,111</i>	<i>0,851</i>	<i>0,000</i>
	N	0,969	-0,122	5,327	2,880	10,864	7,886	4,551
		[16,89]	<i>[-2,25]</i>		<i>0,578</i>	<i>0,102</i>	<i>0,005</i>	<i>0,033</i>
	S	0,893	-0,078	8,535	4,656	5,644	0,030	7,361
		[11,43]	<i>[-3,50]</i>		<i>0,324</i>	<i>0,464</i>	<i>0,864</i>	<i>0,007</i>

Notes: 1. The values in square brackets are the t-statistics and the values in italics are the p-values. The 5% critical value for the t-statistic is 1.645; 2. Only the cointegrated relationships are reported; 3. "WE" is the weak exogeneity test. WE (SA) means the SA variable is being tested for weak exogeneity; 4. The LM and the Portmanteau tests are tested at the same lag as the VECM.

Following the adjustment coefficients, the half-life measures are calculated and they are also a measure of the speed of convergence. The results above show that Swaziland has the highest average half-life measure of 14 months, followed by Namibia and lastly, Lesotho. The error correction terms and the half-life measures discussed above show that for most of the cointegrated relations, half of the adjustments are corrected within 4 to 12 months.

According to Aziakpono (2006:15), “the sluggishness or speed of the adjustment process would suggest the degree of market imperfection or administrative bottlenecks that exist in a country.” Tables 8a and 8b also present the results from the weak exogeneity tests. These tests suggest that, in most cases, long-run causality runs from SA to BLNS counties. In the case of the Namibian deposit rate and lending rate, there are only a few instances where the SA variable is found to be endogenous. This is an indication that, on average, linkage runs from South Africa to the BLNS countries, thereby confirming the dominance of South Africa in the SACU region.

Considering that annual data led to small sample sizes for some of the countries, particularly Namibia, panel cointegration tests were performed on all annualised series i.e. GDP and government expenditure. The results of the Kao cointegration test and the Johansen-Fisher test are presented in Table 10.

Table 10: Panel cointegration results (SADH)

Variables	Kao residual		Johansen Fisher	
	Statistic	p-value	Statistic	p-value
<b>GDP</b>	-0,129	0,449	13,670	0,208
<b>Government expenditure</b>	-1,290	0,099	15,690	0,166

Notes: 1. The selected option for the Johansen test is option 3, which entails including an intercept in the cointegrating equation and VAR; 2. The selected lag for all variables is 1

The results in Table 10 indicate that there is no panel cointegration between SA and the BLNS GDP, and between SA and BLNS government expenditure. The null hypothesis of no cointegration is not rejected in both the Kao residual test and the Johansen Fisher test.

Similar to Aziakpono (2008), for stationary series and the relationships where there is no cointegration, the Granger causality tests were performed to establish the direction of short-run causality, if any, between SA variables and each of the BLNS variables. In the case of non-stationary data, the data was first-differenced before performing the Granger causality test (see Table 11).

Table 11: Variables for Granger-causality tests (SADH)

Variable	Country
<b>Stationary series</b>	
<b>Inflation</b>	L; N
<b>Debt</b>	BLNS panel
<b>Not cointegrated</b>	
<b>Deposit rate</b>	B
<b>Discount rate</b>	B
<b>Lending rate</b>	B
<b>Short-term real interest rate (Deposit rate)</b>	B; L; N
<b>Short-term real interest rate (Discount rate)</b>	B; L; N
<b>Long-term real interest rate</b>	B
<b>GDP</b>	BLNS panel
<b>Government expenditure</b>	BLNS panel

Note that all these variables are paired with the corresponding SA variable

Tables 12 and 13 present the results of the Granger causality tests..

Table 12: Bivariate Granger causality tests (SADH)

Variables	Country	Lags	SA → BLNS	BLNS → SA	Conclusion	LM test (i)	Portmanteau test (i)
<b>Inflation</b>	L	1	14,914	3,635	U	3,162	3,577
			<i>0,000</i>	<i>0,060</i>		<i>0,530</i>	<i>0,470</i>
	N	1	14,450	2,070	U	5,950	6,210
			<i>0,000</i>	<i>0,150</i>		<i>0,200</i>	<i>0,180</i>
<b>Deposit rate</b>	B	1	6,651	2,690	U	13,759	9,466
			<i>0,010</i>	<i>0,100</i>		<i>0,316</i>	<i>0,056</i>
<b>Discount rate</b>	B	3	12,243	4,690	U	3,572	3,829
			<i>0,010</i>	<i>0,200</i>		<i>0,470</i>	<i>0,430</i>
	N	4	43,778	9,073	U	3,448	5,614
			<i>0,000</i>	<i>0,060</i>		<i>0,490</i>	<i>0,230</i>
<b>Lending rate</b>	B	2	23,783	2,057	U	7,572	7,730
			<i>0,000</i>	<i>0,360</i>		<i>0,110</i>	<i>0,100</i>
<b>Short-term real interest rate (Deposit rate)</b>	B	3	8,705	7,165	U	2,037	2,230
			<i>0,030</i>	<i>0,070</i>		<i>0,730</i>	<i>0,690</i>
	L	2	29,281	3,979	U	5,920	8,260
			<i>0,000</i>	<i>0,140</i>		<i>0,210</i>	<i>0,080</i>
	N	4	48,435	29,602	B	2,434	3,425
			<i>0,000</i>	<i>0,000</i>		<i>0,660</i>	<i>0,490</i>
<b>GDP (Q)</b>	B	1	36,203	1,048	U	3,150	4,848
			<i>0,000</i>	<i>0,310</i>		<i>0,530</i>	<i>0,300</i>

Notes: 1. 5% significance level is used; 2. The values in italics are the p-values ; 3. U = univariate causality ; B = bivariate causality

Table 12 shows that for all these relationships, causality runs only from SA to the BLNS variables except for the Namibian short-term real interest rate, which also Granger-causes the SA short-term real rate. As seen in the Granger causality results, although most of the Botswana variables are not cointegrated with SA variables, there is still evidence that the SA variables lead the Botswana variables via the short-run causality. The direction of causality is only from South Africa to Botswana, which is an indication that SA variables lead Botswana variables.

Table 13 shows results of the pairwise Granger causality test and the Dumitrescu Hurlin causality test and both tests show evidence of panel causality of SA GDP on BLNS GDP and SA debt on BLNS debt. However, there is no causality between SA and BLNS government expenditure, either direction. At this stage, the results suggest that no SA fiscal policy variable Granger causes the BLNS corresponding variables.

Table 13: Panel causality tests (SADH)

Variables	Lags	Direction	Pairwise Granger causality	Dumitrescu Hurlin
GDP	1	BLNS → SA	2,169	0,956
			<i>0,140</i>	<i>0,901</i>
		SA → BLNS	2,939	5,409
			<i>0,090</i>	<i>0,000</i>
Debt	1	BLNS → SA	0,020	2,618
			<i>0,890</i>	<i>0,050</i>
		SA → BLNS	1,591	3,839
			<i>0,210</i>	<i>0,000</i>
Government expenditure	2	BLNS → SA	0,043	1,060
			<i>0,840</i>	<i>0,990</i>
		SA → BLNS	1,845	2,317
			<i>0,180</i>	<i>0,098</i>

Notes: 1. 5% significance level is used; 2. The values in italics are the p-values

Overall, the cointegration and causality analysis indicate the level of dependence of the BLNS countries on SA, and there is sufficient evidence to suggest that the BLNS variables react to changes in SA variables. Moreover, the high magnitudes of the long-run coefficients and the speed of adjustments indicate and confirm the degree of dominance of South Africa in the SACU region. From highest to lowest, the degree of dependence on SA by the BLNS countries ranges from Namibia, Lesotho, and Swaziland and, to a limited extent, Botswana. These results are in line with Aziakpono (2008) and Burger *et al.* (2012), who find the validity of the SADH among the SACU countries.



A point to note is that the use of a bivariate analysis is considered a limitation of this study, given that there are other independent variables that could be included in the cointegration analysis instead of limiting it to only one independent variable. Hence, the other articles in this thesis consider in more detail the nature of the dependency relationship.

## **5. CONCLUSION AND POLICY IMPLICATIONS**

Increased integration among economies amplifies the scope of shocks that these economies must consider when applying their domestic stabilisation policies and assessing the impact upon the policy transmission channels (Laopodis 2004). Thus, one of the significant challenges that economies face as they attempt to maintain economic stability is the spillover of economic shocks from the economies to which they are connected. The SACU region is one of the highly integrated regions. The principal component analysis and the investment-saving (I-S) correlation confirmed high integration among the SACU countries. The variables used to test the depth of integration are the nominal interest rates, inflation, gross domestic product, government expenditure, and debt. In the SACU area, South Africa is the dominant country, with Botswana, Lesotho, Namibia, and Swaziland (BLNS countries) dependent on SA, where the South African actions mostly influence the activities of the BLNS countries.

This article explored the existence and extent of South Africa's dominance in SACU. Compared to other studies (e.g. Aziakpono *et al*, 2012; Burger *et al.*, 2012; Zondi, 2012) the main contribution of the article has been the extension of the analysis of the South African dominance hypothesis by including more interest rates and other economic variables such as the fiscal policy variables, inflation, and output. The approach taken is based on the assumption that South African policy and economic variables should convey important information to the other SACU countries' corresponding variables. In other words, it is based on the existence of substantial spillovers from the South African economy to the other SACU countries. These spillovers, and this underlying assumption, were analysed within the cointegration and error correction framework, which is capable of modelling both short-run and long-run relationships among cointegrated variables.

Unit root testing using the KPSS tests, indicated that most of the variables used in the study are integrated of order one. The main finding from the analysis is that there is cointegration between South Africa and the BLNS countries, in particular, between South African and the LNS countries. These findings imply that the customs union can play a fundamental role in the process of improving monetary and financial integration in the SACU region. Moreover, the error correction analysis confirms the monetary and economic dominant role of South Africa in the SACU region. The SADH is evident in SA interest rates, inflation, and GDP influencing their corresponding variables for the BLNS countries.

Generally, the long-run results also show that any changes in the South African economic variables translate into changes in the variables of the BLNS countries. The findings show that Namibia is the most responsive to these changes in inflation and interest rates, followed by Swaziland, then Lesotho and Botswana as the least reactive. Moreover, the average adjustment period for inflation and interest rates is between 4 and 12 months. The results indicate that the BLNS countries have a similar reaction to South African actions. The fast adjustment process of the BLNS countries to the South African actions could be an indication that the SACU countries are highly integrated.

The validity of the SADH was also tested using the Granger causality tests. Evidence of unidirectional interest rate, GDP and inflation linkages from South Africa to other SACU countries suggests the dominant role of South Africa in the SACU region. Confirmation of the dominant position of South Africa in the SACU implies the potential cross-country spillovers stemming from policymakers in South Africa to the other SACU countries. Therefore, given the dominant monetary and economic role of South Africa in the SACU, these potential spillovers from South Africa could pose a challenge to the BLNS countries as they ensure macroeconomic stability of their economies (Rossouw, 2006).

In addition, evidence for the SADH has important implications for the process of monetary and economic integration in the SACU region. Firstly, considering that most of the economic and monetary performance of the BLNS countries react in a similar way to the South African economic actions, a move towards a full monetary union with a regional central bank might be ideal.

Secondly, from a monetary policy maker's perspective, the significant effect of South African interest rates on BLNS interest rates indicates that BLNS interest rates follow the South African stance closely. This is also evidence in support of establishing full monetary integration in the region. According to Aziakpono (2006), such movement in interest rates is a product of policy convergence where smaller SACU countries have aligned their policy interest rates with those of dominant South Africa. Thirdly, it seems reasonable that South African actions play such a dominant role in the BLNS countries because the banking sectors in the BLNS countries are highly integrated with the South African banking sector (Aziakpono, 2008). However, as much as the results indicate an integrated SACU region, there is still more effort needed for the countries to be more integrated.

Further applied research will be necessary to help shape an environment that ensures macroeconomic stability in the SACU region and beyond. Taking all results together, there is compelling evidence that South Africa has a strong and dominant position in the SACU region. A significant question that arises from these findings is how significant the policy spillovers from South Africa to the other SACU countries are. This is a question with which the following articles deal.

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## **APPENDIX - Financial integration literature**

<b>Author</b>	<b>Focus of study</b>	<b>Country coverage (Sample)</b>	<b>Method</b>	<b>Note: Findings</b>
Irاندoust (2019)	Examines the causal relationship between domestic saving and investment rates in six transition economies  As an implication for financial integration	6 Transition economies of Eastern Europe	I-S correlation  Bootstrap panel Granger causality approach	Find causality between investment and savings  Implying that capital is not perfectly mobile internationally
Ginama, Hayakawa and Kanmei (2018)	Empirically examines the Feldstein–Horioka (F-H) puzzle  Notes criticisms of F-H and addresses them through examination of the F-H puzzle	OECD countries (national); Japan, Indonesia, and the Philippines (regional economic)	I-S correlation  A panel model with common factors  Regression residuals method	Support for the existence of Feldstein-Horioka puzzle  Evidence of intranational capital flows mobility
Majewska and Jamroz (2018)	Provide a review of selected measures of financial integration from literature  Presents a dynamic analysis of the level of integration	19 Eurozone stock markets  2007-2012	PCA-based measures - coefficient of determination of the regression model with principal components as the regressors. Integration index constructed using the share of variance explained by the first principal component. Segmentation index constructed using the variation in loadings of the first principal component	Results confirm an increased level of integration of those markets during the period of global financial crisis and the European debt crisis and for a brief period thereafter.
Khan (2017)	Revisit the savings and investment relationship  Capture the dynamic relationship between savings and investment using a state-space model	22 OECD countries	I-S correlation  Time-varying parameter model through Kalman filtering	Found time-varying saving retention coefficient has gradually declined since the mid-'70s for most of the countries under study  The average time-varying saving retention coefficient for the entire sample also showed steady decline

Author	Focus of study	Country coverage (Sample)	Method	Note: Findings
Drakos, Kouretas, Stavroyiannis, and Zarangas (2017)	Investigates the degree of financial integration and international capital mobility by analysing the dynamics of national saving-investment relationships  They consider the non-existence of I-S relationship as evidence of a high degree of capital mobility	14 EU member countries  1970-2013	I-S correlation  Panel ARDL model	Find a close long-run relationship between investment and saving  Also, find evidence for some degree of capital mobility over time
Billio, Donadelli, Paradiso and Riedel (2017)	Compares the different measures of financial integration	Developed and emerging countries  Monthly equity market data	PCA R-squared Volatility-adjusted correlation BEKK-GARCH DCC-GARCH Conditional time-varying beta	Find that all measures show a similar long-run integration pattern
Mitra (2015)	Examine SR and LR relationships between domestic saving and investment rates Implications for capital mobility and financial integration	Philippines  1960-2014	I-S correlation  VECM	No significant long-run relationship between domestic saving and investment rates  Thus the results indicate a high degree of financial integration
Kumar (2015)	Utilise the I-S correlation to investigate the impact of regional integration agreements (AFTA, EU, EFTA, CARTAGENA, MERCOSUR, and NAFTA) on the international capital mobility  Explore the associations between integration, financial intermediaries and productivity for a wide range of countries	44 countries (10 Asian; 22 EU countries; USA; 11 North and South America)  1960-2012	I-S correlation  General to specific (GETS) method of Hendry (1995) to estimate the cointegrating equation and dynamic adjustments	The estimate of saving retention has declined, implying that the international mobility of capital has increased in these countries  Findings reveal that regional integrations stimulate financial intermediation, which in turn, improves real productivity



Author	Focus of study	Country coverage (Sample)	Method	Note: Findings
Chen and Shen (2015)	Test the F-H in the presence of regime shifts  To characterize the time-varying behaviour of the saving retention coefficient	9 European countries	I-S correlation	There is a shift in the saving retention coefficients from high (low capital mobility) to low values (high capital mobility)
Eslamloueyan and Jafari (2014)	Examine the effects of the Asian financial crisis of 1997, and the global financial crisis of 2008 on the behaviour of saving and investment	East Asian countries	I-S correlation  common correlated effects mean group (CCEMG) technique to a set of balanced panel error correction model	Saving and investment rates are highly dependent across the East Asian countries. The adverse financial shock of 1997 negatively affected the short-run correlation between saving and investment but did not influence their long-run relationship. The global financial crisis of 2008 did not affect the saving-investment dynamics in this region
Johnson and Lamdin (2014)	Examine the relationship between investment and saving	European countries  Panel	I-S correlation  Fixed-effects model	There is a significant positive relationship between investment and saving.  Relationship stronger during the height of the euro crisis.
Di Iorio and Fachin (2014)	Test for the existence of stable long-run saving-investments relationship	18 OECD countries  1970-2007	I-S correlation Panel cointegration bootstrap test robust to short- and long-run dependence across units	Evidence of a long-run savings-investments relationship in most of the countries

Author	Focus of study	Country coverage (Sample)	Method	Note: Findings
Slimane, Tahar, and Essid (2013)	Test the hypothesis of perfect capital mobility using the methodology of Feldstein and Horioka [1980]  Examine the correlation between saving and investment	Tunisia and Morocco	I-S correlation  Augment the FH model by introducing additional variables  Cointegration and error-correction model	Interpret the relationship between domestic saving and investment in the long-run as reflecting the solvency constraint rather than as evidence of limited capital mobility. Low values of the coefficients of correlation. Conclude that there is a high degree of capital mobility.
Adeniyi and Egwaikhide (2013)	Re-examine the F-H puzzle - LR linkage between saving and investment How does the financial sector development influence this relationship?  Does the effect of financial sector development hinge on the particular measure of the size and coverage of the financial system adopted?	20 sub-Saharan Africa countries  1976-2005	I-S correlation  panel cointegration  Three panel estimation techniques -pooled OLS, fixed effects and random effects	A prominent role for financial deepening in the saving-investment association emerges from the estimates.  Demonstrated intervening role for financial development in the saving-investment linkage not only sheds fresh light on issues but also leaves much for pondering particularly by policymakers in SSA.
Volosovych (2013)	Examine the degree of capital market integration  Determine the causes of financial market integration	15 industrialised economies (Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, UK, USA)  1875-2009	PCA  Regression analysis (index of integration as a dependent variable)	Evidence of higher integration in the 20th century  Policy variables and global market integration are significant determinants in the variation of the integration index.
Ketenci (2012)	Investigate the level of capital mobility using the F-H puzzle, i.e. relations between saving and investment flows  Important to accommodate for a structural break if present	23 European Union countries  1995Q1-2009Q4	Different cointegration techniques: Johansen + Gregory and Hansen	Stronger evidence of cointegration between investment and saving variables if a structural break is accommodated  Low correlation - high level of capital market openness

Author	Focus of study	Country coverage (Sample)	Method	Note: Findings
Boubakri, Couharde, and Guillaumin (2012)	Assess the degree of financial integration of CEECs with the Euro area	Central and Eastern European countries (CEECs)	I-S correlation panel data unit root tests and cointegration techniques	The incomplete financial integration process of the CEECs with the euro area  Institutional monetary arrangement of these countries matter for integration
Fat and Dezsi (2012)	Study the patterns underlying the linkages between stock markets returns  To assess the real effects of stock markets relationships to international portfolio diversification	12 countries  September 1997-May 2012	PCA  Maximum likelihood	Countries located in the same region and with homogenous economic development exhibit highest correlations (both PCA and ML). The extent of integration in stock markets has implications for international portfolio diversification
Guzel and Ozdemir (2011)	Test the F-H puzzle in the presence of structural shifts  Assert that the relationship between domestic saving and investment series is expected to change with policy regime changes and/or structural changes.	Japan and the USA  1960-2003	I-S correlation  DOLS; Johansen cointegration test	Find that allowing for structural shifts eliminates the "puzzle."
Bangake and Eggoh (2011)	Investigate the F-H coefficients	37 African countries  1970-2006	I-S correlation  Panel cointegration analysis: Pooled Mean Group (PMG); Fully Modified OLS (FMOLS); Dynamic OLS (DOLS)	Shows that there are marked differences in savings retention coefficients for different country groups in Africa  This result confirms previous studies on the F-H puzzle, which indicates that capital mobility is relatively high for developing countries

Author	Focus of study	Country coverage (Sample)	Method	Note: Findings
Schularick and Steger (2010)	Relationship between international financial integration and economic growth  Test for empirical evidence that financial integration boosts economic growth in the first era of financial globalization	1880-1913 (the first era of financial globalisation)  1980-2002	Growth regressions	Financial integration was correlated with economic growth before World War 1 but not today  Channels through which financial integration affected growth - global capital market openness and aggregate investment
Li (2010)	Examine the degree of capital mobility, i.e. integration of capital markets  Investigate the efficiency of capital allocation in China	China  1978-2006	I-S correlation (rates)  Panel (Pooled OLS; FE; RE; Mean group estimator)  Granger causality test (between aggregate investment and income growth)	Find significant positive savings-investment association  View international capital mobility as a significant indicator of financial market integration
Guillaumin (2009)	Investigate the degree of financial integration	East Asian countries  1988-2006	I-S correlation (rates)  Panel unit root and panel cointegration tests  Estimate modified Feldstein-Horioka equations	A high degree of financial integration  High-income countries have stronger financial integration than middle-income countries  Financial integration is stronger in the post-crisis period
Baele, Ferrando, Hordahl, Krylova, and Monnet (2004)	Measure the extent and evolution of financial integration in the Euro area	Euro area  money market, government and corporate bond markets, bank credit market and equity market	PCA	The rising degree of integration

## **ARTICLE II**

### **MONETARY POLICY SPILLOVERS IN THE SACU REGION**

#### **1. INTRODUCTION**

Monetary integration is one of the significant points of focus for African countries. Integration takes several arrangements, which include the formation of a free trade area, the creation of a customs union, and a common market as well as an economic union, which involves monetary and fiscal integration. According to McCarthy (2012), full monetary integration is one of the highest forms of integration. Critical characteristics of monetary integration are:

- Fixed exchange rates of currencies of the member countries between one another;
- The existence of full convertibility of currencies in the region;
- Assignment of the responsibility for exchange rate policy to the area, and
- Designation of the instruments of monetary policy to the region, implying the establishment of a regional central bank.

Several African regional integration arrangements, such as SADC (Patroba and Nene, 2013), ECOWAS (Fwangkwai, 2014) and the CFA franc zone (McCarthy, 2012), aim to become a full monetary union, which is when there is complete monetary integration in a region. Moreover, some of the SADC member countries, South Africa, Botswana, Lesotho, Namibia, and Swaziland, are part of the Southern African Customs Union (SACU). The SACU region incorporates the Common Monetary Area (CMA), the oldest monetary integration arrangement still in existence (McCarthy, 2012). The CMA consists of four of the five SACU countries, South Africa, Lesotho, Namibia and Swaziland, and its main characteristics are (McCarthy, 2012; Wang, Masha, Shirono and Harris, 2007):

- Lesotho, Namibia, and Swaziland (LNS) have their national currencies pegged on par with the South African rand, and the rand circulates freely in the LNS countries alongside the LNS currencies, i.e. the Lesotho Loti, Namibian dollar, and the Swaziland Lilangeni. Although Botswana is not part of the CMA, the value of the Pula is set against a currency basket in which the rand carries a weight of about 60-70%,

- Lesotho and Namibia's central banks foreign reserve requirement of setting the total reserves equal to the amount of currency in circulation,
- There is a free flow of funds within the CMA,
- LNS countries have access to South African money and capital markets,
- There is a *de facto* monetary policy set by the South African Reserve Bank throughout the CMA.

The features listed above indicate that the main characteristic limiting the CMA from becoming a full monetary union is that the member countries have national central banks that are responsible for their monetary policies. This limitation raises the question of whether or not monetary policy should be completely centralised in the SACU region, which is an upgrade of the current CMA to a SACU monetary union. A regional central bank for the SACU region is expected to insulate policy formulation from the influence of national policies, which could help curb inflation and ensure price stability (McCarthy, 2012).<sup>1</sup> However, this implies a loss of monetary policy autonomy for member countries and a restriction of their policy space (McCarthy, 2012).

If the SACU region establishes a regional bank, it means that there will be one authority responsible for formulating monetary policy and ensuring macroeconomic stability for all South Africa and the BLNS countries. According to Wang *et al.*, (2007), the net benefits of setting up a regional central bank depend on how well the member countries react to macroeconomic spillovers. Due to economic and financial linkages among the SACU countries, the prevalence of the transmission of shocks among member countries is high. Considering that South Africa is the largest economy in the region it is most likely that the policy shocks from South Africa could spill over to the other smaller SACU countries, Botswana, Lesotho, Namibia and Swaziland (BLNS).

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<sup>1</sup> There is a possibility of the regional central bank failing to provide the stability needed in the region as highlighted the performance of the European Central Bank and the Bundesbank, which have struggled to insulate the European countries from economic shocks and instability.

Therefore, in an attempt to establish the feasibility of a regional central bank in the SACU region, it is essential to investigate the extent of South African macroeconomic policy spillovers to the BLNS countries as well as establish whether or not the impact of SA macroeconomic policy is the same in all BLNS countries.

Furthermore, the main factors influencing the policy response process include the impact of symmetric or asymmetric shocks on the member countries and the effectiveness of the regional central bank policy in cushioning the effects of asymmetric shocks as well as facilitating the adjustment process (Wang *et al.*, 2007: 29). The response of the BLNS countries to South African macroeconomic spillovers would indicate whether or not the SACU central bank will be ideal for the SACU member countries. South African spillovers are considered because South Africa is the dominant country in the SACU region with the BLNS countries mostly dependent on South Africa. This dominance was established in the previous article on South African dominance hypothesis. Furthermore, because of the harmonised monetary and exchange rate policies of the SACU countries, the monetary policy conduct in South Africa may have implications for the BLNS countries. Therefore, one of the major challenges that BLNS countries could face when attempting to maintain price and economic stability is the spillover of monetary policy shocks from South Africa. Based on the discussion above, this article, therefore, focuses on the extent of South African monetary policy spillovers to the BLNS countries.

In the light of the above discussion, the main objective is to investigate the feasibility of the SACU region having a centralised Southern African central bank by analysing the extent and effects of South African monetary policy spillovers to the BLNS countries. The main objective is addressed through the following secondary objectives:

- i. Use a Phillips curve relationship to establish whether or not South African inflation spills over to the inflation of other SACU countries.
- ii. Use a Taylor-type monetary reaction function to assess how the monetary authorities in the BLNS countries react to South African policy interest rates.
- iii. Establish whether or not there is interest rate pass-through from South Africa to the other SACU countries.

Monetary policy spillovers are the focus of the study because monetary policy is one of the critical elements of macroeconomic policy; hence, the effective conduct of the policy is crucial to the economic performance and prospects of a country. According to Seleteng (2016), economists regard the main objectives of monetary policy as price stability and stable economic growth, where monetary authorities focus on using one or more of the different monetary policy instruments such as setting a policy rate, controlling the money supply or managing an exchange rate (Taylor, 1995)<sup>2</sup>. Monetary policy is transmitted from short-term interest rates to exchange rates and long-term interest rates, and finally to real GDP and inflation. However, this is not the end of the transmission, because there is a feedback mechanism whereby the movements in real GDP and inflation are transmitted back to the short-term interest rate through a policy rule or reaction function (Taylor, 1995; Leeper, Sims and Zha, 1996).

Consequently, the monetary policy spillover analysis in this article will assess both the direct and indirect paths of the South African monetary policy to the BLNS economies. The three monetary policy equations: the Phillips curve, the Taylor rule, and the interest rate pass-through, represent the direct and indirect effects of monetary policy. These three equations used for the spillover analysis stem from the argument by Leeper *et al.*, (1996) that separating the regular response of policy to the economy from the reaction of the economy to policy is a more accurate measure of the effects of policy changes. In this study, the indirect channel of the Taylor rule represents the response of policy to the economy while the direct channel of the Phillips curve and interest rate pass-through represent the response of the economy to policy.

The focus of this article is on the monetary policy spillovers. Apart from contributing to the academic literature on monetary integration and policy spillovers in the SACU region, this article adds value to the previous studies by assessing cross-country responses to policy spillovers. Moreover, the article contributes by identifying the impact of South African monetary shocks on the BLNS countries. This response to South African spillovers will show the extent of monetary integration among the SACU countries.

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<sup>2</sup> Financial stability has over time become one of the policy targets alongside inflation and output goals (Aikman, Giese, Kapadia and McLeay, 2019). However, it is out of the scope of this thesis.



Consequently, this will indicate how the SACU countries react to policy shocks currently and after the establishment of a regional central bank (Harvey and Cushing, 2015). Therefore, establishing a SACU regional bank would only be a good strategy if the SACU member countries have a similar reaction pattern to policy, economic and external shocks.

## **2. LITERATURE REVIEW**

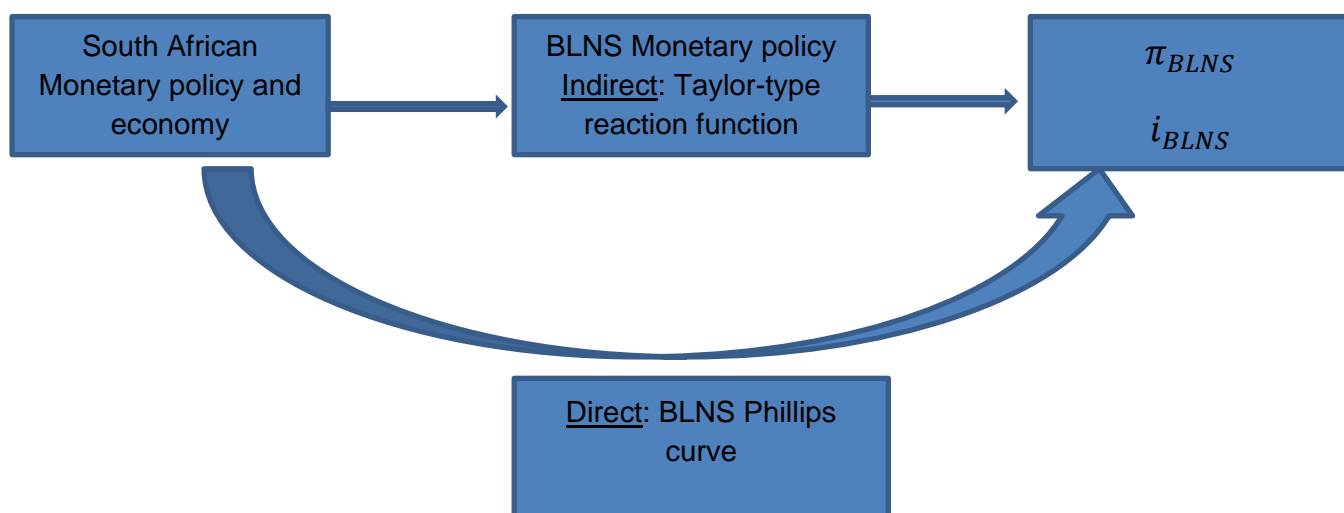
The Common Monetary Arrangement (CMA) as part of the SACU region is highly integrated and has the potential for significant policy spillovers among the member countries. The issue of spillovers in an integrated region points towards the need for economies to coordinate their policies to deal better with domestic and foreign economic shocks among member countries. This need raises the question of how much monetary policy coordination exists among the SACU countries, given the extent of monetary policy spillovers in the region. Furthermore, monetary policy coordination contributes to macroeconomic convergence of member countries, which is a key criterion for determining whether or not the SACU countries should establish a full monetary union.

In setting up a full SACU monetary union, one of the major policy challenges that member countries should consider is the spillover effects of monetary policy shocks in this region. Therefore, this article focuses on the extent of the dominant South African monetary policy spillovers on the BLNS countries to establish the feasibility of full monetary integration. Following is the discussion of the literature on the extent of monetary policy spillovers. Harvey and Cushing (2015) and Alesina, Barro, and Tenreyro (2002) show that an investigation of the degree and nature of the monetary policy spillover effects can be used to determine the feasibility and desirability of setting up a full monetary union. When shocks affect member countries, these countries need to have similar reactions to such shocks to ensure that the same monetary policy can address shock recovery similarly across the region.

Most monetary policy spillover studies that have been done focus on the spillover effects of US monetary policy on large advanced economies, emerging Asian economies, and Latin American economies.

The following literature review on monetary policy spillovers focuses on direct and indirect monetary policy spillovers (see Figure 1). Indirect monetary policy spillover refers to a situation where the South African monetary policy affects the BLNS inflation rate and output via the BLNS monetary policy, whereas direct monetary policy spillover refers to a case where the South African monetary policy affects BLNS inflation rate and output directly and not via the BLNS policy variable.

Figure 1: Monetary policy impact channels



## 2.1. Phillips curve

The Phillips curve is a direct channel of the monetary policy spillover. In 1958, A. W. Phillips, who observed an inverse relationship between money wage changes and the unemployment rate, developed what became known as the Phillips curve. This finding by Phillips (1958) suggests that policymakers could exploit the trade-off to reduce unemployment at a small cost of additional wage inflation.<sup>3</sup> By the late 1960s, early 1970s US data provided mixed evidence to support the original Phillips curve, and this led to the development of the expectations-augmented Phillips curve.

According to Russell and Chowdhury (2013), ‘modern’ Phillips curves are ‘expectation’ based and they are specified as follows:

$$\pi_t = f(\pi_t^e, z_t)$$

<sup>3</sup> However, this is not what Phillips had in mind. He wanted to show that pursuing lower unemployment was possible with higher inflation.

where  $\pi_t$  is the inflation rate in period  $t$ ;  $\pi_t^e$  is the expected inflation conditional on available information and  $z_t$  is a control variable. The control variable,  $z_t$ , is represented in several ways in the literature including the unemployment rate, the unemployment rate gap, the output gap, real marginal costs, income share of labour, and the mark-up of prices over unit labour costs (Russell and Chowdhury, 2013).

The three prevalent theories of the Phillips curve relation are the Friedman and Phelps (F-P) Phillips curve, the New-Keynesian Phillips curve (NKPC) and the hybrid model.<sup>4</sup> The expectations-augmented Phillips curve of Friedman (1968) and Phelps (1967) [F-P Phillips curve] assumes adaptive expectations on inflation where expected inflation is measured as a geometrically declining distributed lag of all past rates of inflation, with the coefficients of past inflation adding up to one. This adaptive expectations assumption is an indication that the F-P Phillips curve is a backward-looking inflation model. The NKPC assumes rational expectations, with no repeated erroneous expectations errors. Moreover, the NKPC model provides optimising microeconomic foundations for the Phillips curve, which are answers to two of the perceived shortcomings of the F-P Phillips curve (Gordon, 2011). According to the NKPC theory, inflation expectations respond to current and anticipated changes in policy, which is a representation of a forward-looking expectations model. However, one of the drawbacks to the NPKC model is that if agents are rational and forward-looking, then reducing inflation is costless (Fuhrer and Moore, 1995; Roberts, 1998; Gali and Gertler, 1999; Galí and Monacelli, 2008). This is inconsistent with the general observation that anti-inflation policies are associated with substantial costs to aggregate output.

The third theory of the Phillips curve is the hybrid Phillips curve, which is a combination of the F-P Phillips curve and the NKPC. This hybrid model incorporates both the forward-looking and backward-looking behaviour on expectations and does not have explicit optimising micro-foundations, compared to the NKPC.

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<sup>4</sup> Mankiw (2001) discusses the sticky information Phillips curves as an alternative way of modelling the Phillips curve which requires data on expectations of current period variables conditional on sequences of earlier period information sets (Reid and du Rand (2013)).

All the above models have been empirically tested in literature, and Table A-2.1a in Appendix A presents a brief overview of the empirical research of these models.

The Phillips curve literature presented in Table A-2.1a shows that there are mixed results on the applicability of the different versions of the Phillips curves, which means that there are mixed findings on the direct monetary policy channel in the literature. Loungani and Swagel (2001), Ball and Mazumder (2015), and Esu and Atan (2017) estimate the expectations-augmented Phillips curves for developing countries, the US and Sub-Saharan African countries respectively. Using the output gap as a measure of economic activity, Loungani and Swagel (2001) find support for the expectations-augmented Phillips curve. Conversely, using the unemployment variable as a measure of economic activity, Ball and Mazumder (2015) find support for the expectations-augmented Phillips curve while Esu and Atan (2015) reject the validity of the expectations-augmented Phillips curve.

Furthermore, Lindé (2005), Yazgan and Yilmazkuday (2005) and Leshoro (2011) estimate the hybrid NKPC for the US, Turkey, and Kenya, respectively. Yazgan and Yilmazkuday (2005) and Leshoro (2011), using output variables, find evidence of the NKPC relation, whereas Linde (2005) rejects the validity of the NKPC model. Most inflation dynamics in different countries support the validity of the hybrid NKPC. Using the output gap as a measure of economic activity, Linde (2005) for the US; Basarac, Škrabić and Sorić (2011) for European transition economies, and Milucka (2014) for the Czech Republic all find support for the hybrid NKPC relations. Gali and Gertler (1999) and Gali *et al.*, (2001) also find support for the hybrid NKPC versions in the US and the Euro area, respectively, using real marginal cost as a measure of the economic activity. Using capacity utilisation as a measure of economic activity, Jensen (2010) tests the applicability of the hybrid NKPC in the Euro area and finds support for the hybrid NKPC relation.

In addition, a few researchers investigated the validity of the open economy hybrid NKPC. These include Paloviita (2008) for the Euro area and Sahu (2013) for India. These authors used the output gap as a measure of economic activity, and they found support for the open economy hybrid NKPC.

The open economy relations are extensions of the hybrid NKPC versions that incorporate foreign variables as possible determinants of inflation in the domestic economy. This inclusion of external variables accounts for spillovers from one country to another.

Lastly, non-linear versions of the Phillips curve have been investigated in literature where there is a possibility of asymmetric relationships between inflation and economic activity. Clark, Laxton and Rose (1996), and Ewing and Seyfried (2003) for the US and DeBelle and Laxton (1997) for Canada, the UK and the USA find support for a strong nonlinear Philips curve relationship. African country studies that find support for a nonlinear Phillips curve include Kobbi and Gabsi (2017) for Tunisia; Hasanov, Arac and Telatar (2010) for Turkey, and Nell (2006). There is also Phillips curve literature that estimates all three standard versions of the Phillips curve (traditional, NKPC and hybrid NKPC) and the model with the best fit chosen. In investigating which Phillips curve has the best fit, Russell (2013), Scheibe *et al.*, (2005) and Melihovs and Zasova (2007) find that the hybrid NKPC version is the best version to explain the inflation dynamics in developed and developing economies. The literature discussed above shows that the hybrid NKPC presents the most applicable direct channel of monetary policy.

Similarly, Table A-2.1b in Appendix A presents the Phillips curve studies for the SACU countries. There is limited research on the Phillips curve relation to the BLNS countries. Table A-2.1b literature shows mixed evidence of the support of the Phillips curve. There is support for the Phillips curve in South Africa (Nkomo, 1999; Fedderke and Schaling, 2005; Phiri, 2016), in Botswana (Sediakgotla, 2017) and Namibia (Shifotoka, 2015). However, there is also literature indicating that the Phillips curve does not apply to South Africa (Chicheke, 2009; Burger, P and Marinkov, 2006; Hodge, 2002; Dadam and Viegi, 2016; Leshoro and Kollamparambil, 2016), and Namibia (Ogbokor, 2005). The most common measure of economic activity used in the estimation of the Phillips curve relation in the SACU region is the output gap. Following the literature above, the output gap is the economic activity measure used in this study.

Nkomo (1999) and Shifotoka (2015) find support for the traditional Phillips curve in South Africa and Namibia respectively, while Chicheke (2009) and Ogbokor (2005) reject the validity of the traditional Philips curve in South Africa and Namibia respectively. Furthermore, Fedderke and Schaling (2005) in South Africa support the applicability of the NKPC version, while Dadam and Viegi (2016) do not support the validity of the NKPC in South Africa. Du Plessis and Burger, R (2006); Phiri (2016) and Sediakgotlha (2017) recommend the validity of the hybrid NKPC for South Africa and Botswana, whereas Leshoro and Kollamparambil (2016) reject the validity of the hybrid NKPC in South Africa. Lastly, a few Phillips curve studies of South Africa find support for the nonlinear specification of the Phillips curve (Nell, 2006; Ngalawa and Komba, 2017).

The existence of Phillips curve relations in a country has implications to monetary policy through guiding monetary authorities on what the important determinants of inflation are. According to Shahbaz, Islam and Shabbir (2012), the main implication of evidence supporting Phillips curve is that central bankers, monetary policymakers and researchers are able to determine how best to stabilise the price level by controlling inflation as well as establishing an unemployment rate or economic growth consistent with low inflation (Shahbaz *et al.*, 2012). Where there is evidence of a non-linear Phillips curve, it means that monetary authorities need to take account of the asymmetry in the conduct of monetary policy (Clark *et al.*, 1996).

In addition, there is limited literature on the use of the Phillips curve to analyse monetary policy spillover effects across countries. However, because the Phillips curve has a long empirical pedigree and is generally accepted as a robust empirical regularity (Bayoumi and Vitek, 2013), a form of the Phillips curve will be used in this article. Although the Phillips curve has mainly been used to examine the inflation dynamics of a single country without accounting for spillover effects from other countries, a few studies have investigated the spillover effects through the Phillips curve relation.

In the SACU region, Nchake (2012) examines how prices in Lesotho react to the South African monetary policy as well as establish the extent of market integration between Lesotho and South Africa.

The author finds that South African monetary policy plays a significant role in the inflation behaviour in Lesotho and that the Lesotho retail market is highly integrated with the South African markets. Similar to the findings in Article 1, Gaomab II (1998) finds a strong positive influence of South African inflation on Namibian inflation. Ndzinisa (2008) estimates three equations of monetary policy (Phillips curve, Taylor rule, and the IS equation) to assess the efficacy of monetary policy on economic growth in Swaziland. Using the Engle-Granger cointegration technique, Ndzinisa (2008) finds that the movement in the South African consumer price index primarily affects Swaziland inflation and that price differentials between Swaziland and South Africa affect Swaziland real GDP. The implication of the existence of Phillips curve spillovers in the SACU region is that there is evidence of a direct monetary policy spillover from South Africa to Lesotho, Namibia and Swaziland.

For the non-SACU region, Osorio and Unsal (2011) present a quantitative analysis of inflation dynamics in Asia using a global VAR that incorporates the role of regional and global spillovers in driving Asia's inflation. The authors find evidence of significant demand-driven inflation spillovers from China to the other countries in Asia. Additionally, Weiguo and Yang (2012) examine the impact of US monetary policy shock on Chinese real output and inflation. Using structural VAR (SVAR) methodology and the Johansen cointegration test, Weiguo and Yang (2012) find that US monetary policy shocks spillover to Chinese real output and inflation. Similarly, Netšunajev and Winkelmann (2014) find evidence of US inflation expectation spillovers to the Euro area, which further highlights the existence of a direct monetary policy channel among the non-SACU countries. In the discussion above, these direct monetary policy shocks originate from a dominant country (or large economy) in a particular region, and they spill over to other countries.

Some of the available literature examines monetary policy spillover effects by estimating either a structural model or a dynamic general equilibrium model, which incorporates the Phillips curve as one of the equations. The discussion that follows in section 2.3 below includes this literature on monetary policy spillovers. Following the research discussed above, this article estimates a form of the Phillips curve to assess the direct monetary policy spillovers from South Africa to the BLNS countries. The function will be of the following form:

$$\pi_j = f(\pi_j^e, \pi_{SA}, \hat{y}_j, \hat{y}_{SA})$$

where  $\pi_j$  is the inflation rate in the BLNS country  $j$ ;  $\pi_j^e$  is the expected inflation (which is proxied by lagged inflation);  $\pi_{SA}$  is the inflation rate in South Africa;  $\hat{y}_j$  is the output gap for the BLNS country  $j$  and  $\hat{y}_{SA}$  is the South African output gap. In particular, the models of each of the BLNS countries include the South African output gap and inflation rate as measures of the spillover effect.

## **2.2. Interest rate pass-through**

Another direct channel of monetary policy is the interest rate pass-through, which shows the transmission of the monetary policy rate to the short-term and long-term interest rates. Traditionally, from the perspective of monetary policy, interest rate pass-through refers to a transmission of a change in the central bank policy rate to aggregate domestic demand and output via retail interest rates. This pass-through represents the magnitude, degree, and speed of reaction of short-term interest rates to changes in the policy rate.

The interest rate pass-through literature has three main branches. One branch focuses on the interest rate pass-through of market interest rates to retail bank rates based on similar-maturity terms (De Bondt, 2002). Another branch is the pass-through of monetary policy rate on retail rates, termed the monetary policy approach (Kleimeier and Sander, 2004). Lastly, a branch that combines the two methods mentioned above, where it initially looks at the transmission of policy rates to market rates and then looks at the transmission of market rates to retail rates (Berstein and Fuentes, 2003). The focus of this study is on the modified monetary policy approach where the South African monetary policy is transmitted to the monetary policy rates of the BLNS countries, a direct channel of monetary policy spillovers. Economists have studied the interest rate pass-through extensively, and Table A-2.2a in Appendix A presents some of the literature.

The literature in Table A-2.2a shows that the pass-through tested is either from the money market rates to the long-run rates (Toolsema, Sturm and De Haan, 2002) as well as from the policy interest rate to the short-term and long-term interest rates, referred to as the monetary policy approach (De Bondt, 2005).



The monetary policy approach is one of the channels of monetary policy in which the monetary policy can affect the economy, and it is the pass-through tested in this study. The degree of pass-through indicates the effectiveness of monetary policy transmission (De Bondt, 2002; Horváth, Krekó and Naszódi, 2004).

Some of the studies reported in Table A-2.2a compare the nature and degree of interest rate pass-through among the Euro countries to establish the effect of the common monetary policy in the Euro area (Heinemann and Schuler, 2002; De Bondt, 2005; Hofmann, 2006; Sorensen and Werner, 2006; Creel, Viennot and Hubert, 2013; Borstel, Eickmeier and Krippner, 2015). The main findings are that the transmission mechanism of policy interest rates to the long-term rates differs across countries which implies weak convergence of monetary policy transmission in the European Monetary Union (Beckmann, Belke and Verheyen, 2012; Toolsema *et al.*, 2002). This finding implies that this heterogeneous pass-through in the Euro area could severely hamper the common monetary policy of the ECB. In other words, cross-country differences in the interest rate pass-through could complicate the implementation of a single monetary policy in the countries forming the Euro area (Mojon, 2000).

Furthermore, Aziakpono, Kleimeier and Sander (2012) use the interest rate pass-through to examine the extent of integration among the SADC countries, and they define increased monetary integration among countries as a situation where various countries have similar transmission mechanisms of monetary policy rates to short-term bank rates. Part of their study finds evidence of interest rate pass-through of South African monetary policy rate to the other SADC countries' national short-term rates. This finding raises the question of how the SA monetary policy rate passes through to the BLNS countries' monetary policy rates.

Another study on African countries by Misati, Nyamongo, Esman and Kamau (2011) examine the degree of pass-through of monetary policy interest rates to deposit and lending interest rates and finds incomplete pass-through of Kenyan monetary policy interest rates both in the short-run and long-run. This incomplete pass-through indicates an inefficient Kenyan money market which poses serious impediments in the implementation of policy changes to the final target variables (Misati *et al.*, 2011: 179).

In a monetary union setup, Heinemann and Schurler (2002) test interest rate pass-through in the EMU and they find that higher financial market integration increases the degree and speed of interest rate pass-through. Moreover, interest rate pass-through establishes the effectiveness of a regional central bank or a single monetary policy within a group of countries.

Egert and MacDonald (2006) also seek to answer the question of the transmission of the common monetary policy of the European Central Bank (ECB) monetary policy within the CEE countries. Crespo-Cuaresma, Egert and Reininger (2006) and Egert and MacDonald (2006) find low interest rate pass-through among a group of Central and Eastern Europe (CEE) countries, using a multivariate VAR framework. According to Aziakpono *et al.*, (2012), if the pass-through from policy rates to retail interest rates leans towards homogeneity across countries, then there is monetary integration in the region and a regional central bank would be more effective. Moreover, a shift to a regional central bank may contribute to macroeconomic convergence, thereby reducing the heterogeneity across countries.

Some regions have a dominant nation that *de facto* formulates the monetary policy of that region. An example is the SACU region, where South Africa dominates the smaller SACU countries (Botswana, Lesotho, Namibia, and Swaziland - BLNS). In these countries, domestic interest rate pass-through is small compared to the interest rate pass-through from the dominant central bank rate to the national interest rates (Aziakpono *et al.*, 2012). This low national interest rate pass-through means that the domestic interest rates align themselves more to central bank rates of a dominant country and could lead to a more homogeneous interest-rate pass-through as well as increased monetary integration. The pass-through methodology in this study is similar to the one by Aziakpono *et al.*, (2012), who model pass-through as a VAR process with a focus on the interest rate pass-through of the South African central banks to the other countries' bank rates.

The general conclusion from the literature above is that a majority of countries exhibit incomplete and heterogeneous pass-through and that macroeconomic conditions can affect the interest rate pass-through (Egert and MacDonald, 2006).

The main implication of heterogeneity in monetary transmission across countries is that it may seriously impede the effectiveness of the common monetary policy of a regional central bank.

On spillover analysis, the literature on the interest rate pass-through focuses on the spillover of monetary policy with interest rate pass-through being one of the components investigated (Albagli, Leiva-Leon and Saravia, 2016; Sánchez-ordóñez, 2017; Potjagailo, 2017; Edwards, 2017). In evaluating the effect of US policy actions on economic fundamentals of Latin American emerging markets, Albagli *et al.*, (2015) and Edwards (2017) find significant evidence of US interest rate spillovers to the Latin American economies. Moreover, Edwards (2015) looks at Asian countries and finds that the significant US policy rate pass-through is higher in Latin American economies than in Asian ones, which could be an indication of higher integration between the USA and the Latin American economies. Similarly, Bernoth and König (2016) find evidence that US interest rates spill over to Euro rates. For emerging Asian economies, Belke, Dubova and Volz (2017) examine the long-term interest rate spillovers from the Eurozone and the US to emerging Asian economies. The authors find significant pass-through, and the degree of pass-through varies across countries. Moreover, Miyajima, Mohanty and Yetman (2014) find that the US policy rate spills over to Asian economies via the long-term interest rate.

The European countries have also been a subject of monetary policy spillover analysis where the transmission mechanism of the European Central Bank's monetary policy is a cause for concern for the EU countries. Potjagailo (2017) find significant interest rate pass-through spillovers and the degree of pass-through is higher for countries that are financially integrated. These significant pass-through spillovers have an implication for domestic monetary policymaking, in that interest rates are one of the effective monetary policy transmission mechanisms. The interest rate pass-through spillovers tend to be higher where economies are highly integrated. Therefore, monetary and financially integrated economies should consider the effects of foreign monetary policy actions in their domestic economic conditions.

Following the literature discussed above, the analysis of the direct monetary spillover effect using the interest rate pass-through involves testing relationships between the central bank policy rate of a dominant economy and monetary policy rates of smaller

economies. In particular, this article intends to test whether or not the BLNS monetary policy rates react to changes in the South African central bank policy rate. The monetary reaction function analysis discussed in the following section incorporates the interest rate pass-through.

### **2.3. The monetary policy reaction function**

Taylor (1995) highlights that the indirect transmission of monetary policy links the movements in real GDP and inflation back to the short-term interest rate through a policy rule or a reaction function. A monetary reaction function for a central bank indicates the response of the policy rate to economic variables and establishes the goals that influence the actions of the central bank (Setlhare, 2004). The most common policy reaction function is the Taylor rule, as suggested by Taylor (1993), and it is useful when examining the conduct of monetary policy. A simple Taylor rule describes an interest rate feedback policy that is a linear function of both the deviation of actual inflation from target inflation and the output gap and is as follows:

$$i_p = f(\hat{\pi}, \hat{y})$$

where  $i_p$  is the policy interest rate or the short-term interest rate;  $\hat{\pi}$  is the inflation gap between the inflation rate and the target inflation and  $\hat{y}$  is the output gap between the level of output and the potential output.

According to Taylor (1993: 200),

“the monetary authorities are assumed to adjust their interest rate in response to either the deviations of the money supply from its target, deviations of the exchange rate from its target or the weighted deviations of the inflation rate and real output from their targets”.

Moreover, Taylor (1993) asserts that an interest rate rule is preferable to an exchange rate rule or a money supply policy rule. Using a multi-country model for the G7 countries, Taylor (1993) finds that a preferred interest rate rule in the G7 countries is the one that places positive weight on both the price level and real output. However, the sizes of the weights depend on the economic conditions in each country.

Taylor rules have been modified to include additional variables such as exchange rates, money supply, private sector credit, and foreign policy variables; and are referred to as Taylor-type functions. The Taylor-type functions are the most common policy rules used in literature, and they describe interest rate setting behaviour by central banks with some autonomy over monetary policy. The main monetary policy goals are price stability and economic growth and these enter as determinants of the policy rate in the Taylor rule. Therefore, the Taylor-type rule is a form of a central bank's monetary policy reaction function that indicates the response of a country's policy rate to changes in inflation and output gap, as well as any additional variables that central banks would consider as essential variables for monetary policy conduct.

This article estimates a Taylor-type reaction function to measure the indirect monetary policy spillovers in the SACU region. A substantial literature has accumulated on Taylor-type rules and reaction functions, and its discussion follows. Monetary reaction function literature indicates the extensive use of Taylor-type rules in evaluating the monetary policy transmission mechanisms in both developed and developing countries. Mcnees (1992); Clarida, Gali and Gertler (1998); Mehra (1999), and Roskelley (2016) estimate the Taylor-type reaction functions for the US, and they all find support for the Taylor-rule relation. Their results also indicated that a forward-looking Taylor rule best fits the US data. Moreover, Moura and Carvalho (2010) find support for the Taylor rule in Latin American economies.

For the Euro region and New Zealand, Boeckx (2011) and Santacreu (2005) find evidence of the Taylor rule. De Brouwer and O'Regan (1997) find support for a Taylor-type monetary reaction function in Australia. Girardin, Lunven and Ma (2013) and Ping and Xiong (2003) find evidence for the Taylor rule in China. Moreover, Rotich, Kathanje and Maana (2008), and Arbatli and Moriyama (2011) examine the conduct of monetary policy for Kenya and Egypt, respectively. Their findings provide support for Taylor rule that incorporates both backward-looking and forward-looking behaviour. However, some studies find no support for the original Taylor rule relation with either inflation or the output gap insignificant. In their analysis, Huang and Shen (2001) indicate that only inflation is significant in a Taylor rule function for Taiwan, while the output gap is insignificant.

Similarly, Sánchez-Fung (2000) and Inoue and Hamori (2009) find an insignificant output gap for the Dominican Republic and India, respectively.

For the SACU countries, most of the Taylor rule literature shows that the monetary policymakers incorporate the spillover component of monetary policy in their reaction functions (see Table A-2.3b). Setlhare (2014), Bleaney and Lisenda (2001), and Gaotlhobogwe and Manyabeza (2008) estimate a Taylor-type reaction function for Botswana which includes a South African interest rate, and they all find a significant Taylor-type function. Additionally, Kganetsano (2007) and Munyengwa (2012) estimate a Taylor-type reaction function for Botswana that includes South African inflation and finds evidence of the Taylor rule in Botswana. Matlanyane (2005) develops a macro-econometric model for Lesotho and finds that the nominal Treasury bill rate of Lesotho is linked to national real economic activity, inflation, and SA interest rates. Namibian studies show that monetary policy decisions of South Africa spill over to Namibia through the interest rate and the exchange rate (Uangata and Ikhide, 2002; Fleermuys, 2010; Kamati, 2014). Uangata and Ikhide (2002) and Kamati (2014) find that Namibian inflation and the Namibian output gap are significant in explaining changes in interest rates. However, Fleermuys (2010) shows that there is an insignificant relationship between the interest rate and the output gap in Namibia.

With regard to foreign variables added to the Taylor rule, Setlhare (2004) and Munyengwa (2012), find that the exchange rate and the South African interest rate are significant variables for the conduct of monetary policy in Botswana, whilst Bleaney and Lisenda (2001) and Gaotlhobogwe and Manyabeza (2008) find that the exchange rate is insignificant. Matlanyane (2012); Uangata and Ikhide (2002); Fleermuys (2010) and Kamati (2014) show that South African interest rates are significant variables in explaining changes in interest rates in Lesotho and Namibia. The significance of the South African interest rate in the estimated monetary reaction functions is an implication of the existence of policy spillovers from a dominant economy to smaller closely integrated economies.

South African data fits the Taylor-type reaction functions well (Aron and Muellbauer, 2002; Ortiz and Sturzenegger, 2007; Naraidoo and Raputsoane, 2010; Woglom, 2003; Ncube and Tshuma, 2010).

To determine spillovers to South African monetary policy, Aron and Muellbauer (2002), Ncube and Tshuma (2010) and Woglom (2003) include the US interest rate and the real exchange rate as explanatory variables in the SA monetary reaction function. The authors found the additional variables to be significant in the Taylor specification. A few studies have made an attempt at estimating non-linear Taylor-type reaction functions. These studies include Naraidoo and Raputsoane (2010) and Ncube and Tshuma (2010) for South Africa, Taylor and Davradakis, (2006), and Boinet and Martin, (2008) for the UK, as well as Surico, (2007) for the European central bank. Non-linear Taylor rules mean that there are asymmetric responses of interest rates to inflation and output gap (Naraidoo and Raputsane, 2010). Therefore, the literature shows that a Taylor-type monetary reaction function fits the data well for most countries, unlike the original Taylor rule.

There is considerable literature on monetary policy spillovers using a Taylor-type monetary reaction function and a brief discussion of the spillover effects literature follows. Most of the studies that use Taylor-type reaction functions refer to the reaction functions as open economy Taylor-type rules (Arbatli *et al.*, 2011; Clarida, Gali and Gertler, 1998). There is limited literature on the indirect monetary policy spillovers in the SACU region. Bleaney and Lisenda (2001) estimate a Taylor-type reaction function for Botswana, incorporating a South African interest rate as one of the independent variables. They find that the South African interest rates are not significant in Botswana's reaction function. However, by examining the conduct of Botswana monetary policy through a Taylor-type monetary reaction function, Setlhare (2004) and Gaotlhobogwe and Manyabeza (2008) find a statistically significant South African interest rate. Kamati (2014) shows that South African interest rates are significant in explaining the Namibian interest rates. The existence of South African spillovers has implications for the monetary policy conduct of Botswana and Namibia because their central banks need to consider the SA interest rate behaviour when setting the domestic policy rates.

Most spillover studies of the monetary policy reaction function look at the effect of the US interest rate on the interest rate of other countries (Clarida *et al.*, 1998; Ramos-francia and García-Verdú, 2014; Gray, 2013; Caceres, Carriere-Swallow, Demir and Gruss, 2016).

These studies find that US policy rates spill over to smaller economies through their monetary policy reaction functions. Clarida, Gali, and Gertler (1998) estimate monetary policy reaction functions for the G3 countries (Germany, Japan, and the US) and the E3 countries (UK, France, and Italy). They find statistically significant but quantitatively small spillovers across these countries.

There is a limited number of monetary policy spillover analyses for the SACU region, using Taylor-type monetary reaction functions. The estimated monetary reaction function in this article models the short-term policy interest rates of the BLNS countries as a function of BLNS inflation rates, the South African inflation rate, the BLNS output gaps, the South African output gap, and the South African monetary policy rate. Therefore, following the literature discussion above, the reaction function will be of the following form:

$$i_{pj} = f(\pi_j, \pi_{SA}, \hat{y}_j, \hat{y}_{SA}, i_{PSA})$$

where  $i_{pj}$  is the policy interest rate of each of the BLNS countries,  $j$ ;  $\pi_j$  is the inflation rate of the BLNS country  $j$ ;  $\pi_{SA}$  is the South African inflation rate;  $\hat{y}_j$  is the output gap of the BLNS country  $j$ ;  $\hat{y}_{SA}$  is the South African output gap; and  $i_{PSA}$  is the South African policy interest rate. This reaction function above not only includes the South African interest rates (as indicated by SACU literature) but also incorporates the South African inflation rate and output gap to assess the monetary policy spillover effects of South Africa to the BLNS countries. The significance of the South African policy rate highlights the interest rate pass-through spillover from South Africa to the BLNS countries. The primary and novel contribution of this spillover analysis is the introduction of the South African inflation rate and the South African output gap in the monetary reaction functions of the BLNS countries. Another contribution is that this study will contribute to the empirical literature by using 'cross-border' monetary policy spillover analysis for the SACU countries to establish the need to centralise the monetary policymaking to a regional bank for all the SACU countries.

Most of the literature on monetary policy spillovers examines the transmission mechanism of the foreign policy rate to the macroeconomic and financial conditions of the domestic economy.



The United States is the common foreign country as it is considered “...to be the world’s largest economy by the size of its GDP and is the centrepiece of the international financial system” (Garcia and Bolanos, 2017:3). The common finding is that the US monetary policy significantly spills over to the monetary policy in emerging market economies (Miyajima *et al.*, 2014; Tillmann, 2016; Anaya, Hachula and Offermanns, 2017; Ramos-francia and García-Verdú, 2014; Gray, 2013; Chen, Mancini-Griffoli and Sahay, 2014); to countries in the Pacific Basin (Edwards, 2015) and to Asian economies (Miyakoshi and Jalilov, 2005; Sutherland, 2010). Sanchez-Ordóñez (2017) find a significant and high degree of international spillover of the US monetary policy rate to the Colombian policy rate. Moreover, Fic (2013) examines the impact of unconventional monetary policy measures adopted in developed economies on developing economies and finds that the US monetary policy affects developing economies.

Such spillovers of foreign monetary policy decisions are a vital concern, particularly to smaller emerging economies and, therefore, some form of monetary policy coordination is necessary (Sanchez-Ordóñez, 2017). There is also evidence of the spillover of US monetary policy shocks to other macroeconomic variables such as inflation, economic growth and private sector credit (Canova, 2005; Chen *et al.*, 2014). The results indicate that the US monetary policy has large and significant spillover effects on several macroeconomic variables in the Latin American economies and that the interest rate channel is a crucial channel of US monetary policy spillovers, while the trade channel plays a negligible role. The impact of the monetary policy on these economies varies with the extent of their exposure to the US economy as well as their trade and financial linkages. For example, Chen *et al.*, (2014) find that there are significantly smaller monetary policy spillovers to emerging market economies if they have a higher real GDP growth, stronger external current account position, and lower inflation as well as a lower share of local debt held by foreigners. The evidence of asymmetric spillovers across emerging market economies means that the degree and nature of spillovers depend on the country-specific characteristics.

For the Euro area, Kucharcukova, Claeys and Vasicek (2016) and Potjagailo (2017) investigate the spillover effects of the ECB's monetary policy to assess the readiness of the EU countries outside the Euro area (Czech Republic, Hungary, Poland, Denmark, Sweden, and the UK) in joining the Eurozone. The authors find significant spillover effects of the monetary policy shocks to European countries outside the Euro area. Vespignani (2015) examines the international transmission of US, Japanese and Chinese monetary shocks to the Euro area and find that there are significant spillover effects of monetary policy on the Euro area.

Some of the available literature examines monetary policy spillover effects by estimating either a structural model or a dynamic general equilibrium model, which incorporates the Phillips curve, the interest rate pass-through, and a Taylor-type reaction function as one of the equations. This literature includes Laxton and Prasad (2000) who analyse the international spillover effects of US shocks to major industrial economies. The authors estimate a Phillips curve relationship for the industrial economies where inflation is a function of the output gap and the US output gap. Their results show that the US output gap spills over to inflation in other countries. Furthermore, according to Haberis and Lipinska (2015), Botswana, Lesotho and Swaziland use a standard small open economy Keynesian model to show that monetary policy strategies in a large foreign economy affect monetary policy in a small domestic open economy. The authors include a Phillips curve as one of the equations in the model, and this Phillips curve presents inflation as a function of the domestic output gap, lagged inflation, the foreign output gap, and foreign inflation. These external variables are measures of the monetary policy spillovers from the foreign economy to the domestic economy.

Hayo and Niehof (2013) analyse the effects of monetary policy spillovers on financial markets and the feedback from financial markets to the real economy. They extend the NKPC by accounting for spillover effects from US monetary variables to Canadian real variables and from US real variables to Canadian monetary variables. Hayo and Niehof (2013) find evidence of spillover effects of the US monetary policy to the Canadian economy.

Vymyatnina (n.d.) constructs a small inter-country, forward-looking econometric model based on the NKPC for Russia, Belarus, and Kazakhstan. Vymyatnina (n.d) models inflation as a function of expected future inflation, the domestic inflation rate, the inflation rate from other countries and the domestic output gap. The results show that inflation in Belarus responds to Russian monetary policy changes as indicated by the significant coefficient of the Russian inflation and Russian output gap. Moreover, Dekle and Hamada (2015) investigate how Japanese expansionary monetary policy affects the US and whether or not Japanese expansionary monetary policy has positive spillover effects on the US. The authors use VAR models that include an estimation of the Philips curve with inflation in the US expressed as a function of the US output gap, the Japanese output gap, and inflation. Dekle and Hamada (2015) find that the Japanese output gap has a positive effect on US inflation, although the effect is economically small.

A few studies for African countries include Kronick (2014) for Sub-Saharan countries, Seleteng (2016b) for the Common Monetary Area countries, Setlhare (2014) for Botswana, Matlanyane (2005) for Lesotho, Fleermuys (2010) for Namibia and Aron and Muellbauer (2002) for South Africa. Seleteng (2016) investigates the spillover of the South African repo rate to macroeconomic variables in the CMA. Using a panel vector autoregression (PVAR) methodology, Seleteng (2016) finds that a shock to the South African repo rate significantly affects CMA lending rates, inflation, and economic growth. The discussion of some of the spillover studies for the SACU countries is in the section presenting the empirical literature of Taylor rules.

### **3. METHOD**

The monetary policy spillover in this article refers to the significant transmission of South African monetary policy variables onto the BLNS monetary policy and economic variables, i.e. a significant reaction of the BLNS policy rate and economic variables to changes in the South African policy rate (Sanchez-Ordenez, 2017:4). The changes in the policy rate are expected to filter throughout the economy by affecting financial and macroeconomic activity.

This transmission means that central banks can use their policy interest rates to move the economy towards achieving macroeconomic goals such as full employment, price stability, and economic growth.<sup>5</sup> Traditionally, the macro goal variables are the inflation rate, economic growth or gross domestic product (GDP) and the long-term interest rate. Therefore, the spillover analysis in this article refers to the investigation of the role of South African (dominant country) monetary policy and goal variables and the exchange rate in the monetary transmission dynamics of BLNS countries (smaller countries).

Given that monetary policy affects its goal variables indirectly, the transmission of monetary policy to these variables is through various channels. Common channels include the interest rate channel, the credit channel, the exchange rate channel and the asset price channel (Mishkin, 1996). The interest rate channel refers to the changes in market interest rates, brought about by a change in the policy rate, which then leads to changes in investment patterns and the output. The expected reaction to an increase in the monetary policy rate is as follows:

$$\begin{aligned} \uparrow \text{policy rate} &\rightarrow \uparrow \text{market interest rates} \Rightarrow \uparrow \text{cost of borrowing} \rightarrow \\ &\downarrow \text{investment and consumption} \rightarrow \downarrow \text{output} \end{aligned}$$

The credit channel focuses on the transmission of monetary policy through the changes in the supply of loans/credit offered by banks. According to Mishkin (1996), the bank-lending channel focuses on changes in the financial environment for smaller firms. The expected reaction to an increase in the monetary policy rate is as follows:

$$\begin{aligned} \uparrow \text{policy rate} &\rightarrow \uparrow \text{market interest rates} \rightarrow \downarrow \text{bank reserves and bank deposits} \rightarrow \\ &\downarrow \text{available bank loans} \rightarrow \\ &\downarrow \text{investment spending and consumer spending} \rightarrow \downarrow \text{output} \end{aligned}$$

The exchange rate channel refers to the transmission of monetary policy actions via the exchange rate, where a change in the policy interest rate affects the value of the domestic currency, then the net exports and lastly, output.

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<sup>5</sup> However, the previous chapter showed that the BLNS countries' policy variables are dominated by the South African monetary policy variables, and are, therefore, partially dependent on South African actions

The more open a country is, the more effective is the channel. The expected reaction to an increase in the monetary policy rate is as follows:

$\uparrow$  *policy rate*  $\rightarrow$   $\uparrow$  *market interest rates*  $\rightarrow$   $\uparrow$  *foreign capital inflows*  $\rightarrow$   
 $\uparrow$  *appreciation of the domestic currency*  $\rightarrow$   $\downarrow$  *competitiveness*  $\rightarrow$   
 $\downarrow$  *net exports*  $\rightarrow$   $\downarrow$  *output*

In the asset price channel, the movement of monetary policy is through asset prices:

$\uparrow$  *policy rate*  $\rightarrow$   $\uparrow$  *market interest rates*  $\rightarrow$   $\downarrow$  *equity (share) prices*  $\rightarrow$   
 $\downarrow$  *investment spending and consumer spending*  $\rightarrow$   $\downarrow$  *output*

The significance and applicability of these channels differ across countries due to the varying depths of financial systems, different economic structures, and economic activities.

There are several methods used in literature to investigate international monetary policy spillovers. These include the

- global vector autoregression (GVAR) framework (cf. Dekle and Hamada, 2015; Georgiadis, 2016; Fadejeva, Feldkircher and Reininger, 2017);
- time-varying parameter factor-augmented VAR (FAVAR) (cf. Kazi, Wagan and Akbar, 2013; Liu, Mumtaz and Theophilopoulou, 2014);
- full information maximum likelihood (FIML) method (cf. Cho and Moreno, 2003), the small three equation macro model (cf. Gordon, 2005);
- a structural vector autoregression (SVAR) framework (cf. Dungey and Fry, 2003; Sousa and Zaghini, 2004; Vespignani, 2015);
- SVAR with block exogeneity (SVARX) (cf. Canova, 2005; Mackowiak, 2007; Catao, Laxton and Pagan, 2008; Sato, Zhang and McAleer, 2011; Allegret, Couharde and Guillaumin, 2012; Sanchez-Ordenez, 2017).

The alternative methods listed above are not used in this article because of the sample size limitation and limited availability of macroeconomic data in the smaller SACU countries. The methods used in this article are the structural vector autoregression (SVAR) framework and the Diebold-Yilmaz (DY) spillover analysis.

The SVAR method is used to analyse short-run dynamic interactions among the monetary policy variables in the SACU region and indicate the effects of policy shocks. The SVAR method is useful for this study because it takes a theory-guided approach to economic data where restrictions are compatible with several theories (Gottschalk, 2001). Furthermore, the use of the Diebold-Yilmaz approach is because it provides a spillover index that measures the contribution of the South Africa monetary policy shocks to the BLNS countries. The index also condenses and summarises information from the variance decompositions, into more focused and easily interpretable spillover measures (Cotter, Hallam and Yilmaz, 2017). These two methods combined will help capture and quantify the linkages between the South African monetary policy and the BLNS countries.

### **3.1. Structural Vector Autoregression**

For fully exploring the spillovers of South African monetary policy to the BLNS countries, this study uses a structural vector autoregression (SVAR). Sims (1980) introduced the VAR methodology, which is a common framework used in the empirical literature of international monetary policy spillovers. The choice of the SVAR approach for the study stems from its usefulness in exploring the implication of a given theoretical view for the dynamic behaviour of the variables of interest (Gottschalk, 2001). According to Sousa and Zaghini, (2007:404), the SVAR approach is a powerful tool for investigating the dynamic interactions because it "...controls for the linkages between variables which allows for providing an appropriate assessment of the contribution of monetary shocks to output and inflation".

However, the SVAR method has its drawbacks which include the notion that

"economic shocks recovered from an SVAR do not resemble the shocks measured by other mechanisms, and may reflect variables omitted from the model. Also, the results of many SVAR exercises are sensitive to the identification restrictions" (Fernandez-Villaverde and Rubio-Ramirez, 2013:6)

The main applications of SVAR models include impulse-response analysis of time series variables to a given one-time structural shock, and quantification of the average and cumulative contributions of a particular structural shock to fluctuations of a variable over time (Kilian, 2013).

Furthermore, an impulse-response function traces the reaction paths of variables to an unexpected structural shock and is useful in assessing the transmission of shocks to economic variables in a system of variables. The variance decomposition analysis is useful in identifying the critical sources of fluctuations of a variable (Kilian, 2013). A structural form equation of the VAR model of each of the BLNS economies can be written, according to Pfaff (2008) and Sanchez-Ordenez (2017) as:

$$A_0 y_t = A(L)y_t + \varepsilon_t \quad (1)$$

where  $y_t$  is a  $n \times 1$  vector of variables;  $A_0$  is a  $n \times n$  matrix that specifies the contemporaneous relationships between variables;  $A(L)$  is a  $n \times n$  lagged coefficient matrix and  $\varepsilon_t$  is a  $n \times 1$  vector of structural disturbances that are assumed to be white noise. The strategy adopted in the article is to include the variables that account for the direct and indirect channels of monetary policy transmission. The Phillips curve (PC) and the interest-rate pass-through (IRPT) represent the direct channel, while the monetary policy reaction function (MPRF) represent the indirect channel.

Following Kim (2001), Dungey and Fry (2003), Sousa and Zaghini (2004, 2007), Berkelmans (2005), Cheng (2006), Kilian (2011), Raghavan, Silvapulle and Athanasopoulos (2012), Burger, P *et al.*, (2012) and Sanchez-Ordenez (2017) the variables in the VAR are ordered in such a way that the policy target variables (output and inflation) come before the policy instruments. Hence, the VAR ordering of the variables is as follows:

$$\text{Botswana} \rightarrow [\hat{y}_{SA} \quad \pi_{SA} \quad i_{SA}^p \quad \hat{y}_B \quad \pi_B \quad i_B^p]' \quad (2)$$

$$\text{Lesotho, Namibia and Swaziland} \rightarrow [\hat{y}_{SA} \quad \pi_{SA} \quad i_{SA}^p \quad \pi_k \quad i_k^p]' \quad (3)$$

where  $\pi_j$  represents the inflation rates for South Africa and Botswana;  $\pi_k$  is the inflation rate for each of the LNS countries; e SACU country,  $\hat{y}_j$  is the output gap of the SACU country  $j$ ; and  $i_{pj}$  is the policy interest rate of each of the countries. The estimated SVARs for each of the BLNS countries will include the South African monetary policy variables to capture the international monetary policy spillovers.

Sanchez-Ordóñez (2017) asserts that, firstly, a reduced form of VAR is estimated and identifying restrictions are then imposed on contemporaneous variables to be able to extract the coefficients of the SVAR model.<sup>6</sup> In line with studies on monetary policy transmission mechanism, two main methods of identifying restrictions are the Cholesky decomposition and the structural decomposition (Tsangarides, 2010). The Cholesky decomposition places restrictions on contemporaneous structural parameters (matrix  $A_0$ ), by using a recursive structure. This is sensitive to the different ordering of variables. The Cholesky ordering sometimes produces unrealistic restrictions and economically meaningless solutions if not founded on economic theory (Sanchez-Ordóñez, 2017; Kilian, 2011).

Moreover, a recursive ordering is likely to be invalid for small and more open economies (Cushman and Zha, 1997) and “may not be appropriate when identifying the simultaneous contemporaneous relationships between policy instruments and money market variables” (Raghavan *et al.*, 2012:3847). Alternative identification restrictions, such as the non-recursive structure, are more appropriate for representing small economy models like the BLNS countries. Therefore, following Ordóñez-Sánchez (2017), Raghavan *et al.*, (2012), Mackowiak (2007), and Leeper *et al.*, (1996), the identified SVAR models in this article use a non-recursive restriction of the contemporaneous parameters in the matrix  $A_0$ .

Monetary policy equations representing the indirect and direct spillovers (PC, IRPT, and MPRF, respectively) guide the restrictions imposed. The variables included in the SVARs are GDP, inflation, and policy interest rate. Since the BLNS countries are relatively small and open to South Africa, their variables are expected to have little or no effect on the South African economy. Therefore, the ordering of variables starts with the SA variables, since they affect the BLNS countries contemporaneously, while the inverse is unlikely to be true. The South African variables appear first in the SVAR model and are included in each of the BLNS SVARs to measure the monetary policy spillovers.

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<sup>6</sup> Identifying restrictions is a process of disentangling structural innovations from the reduced-form innovations i.e. orthogonalisation of the reduced-form errors.



After estimating the SVAR models, the impulse response function and variance decomposition analysis provide the speed of adjustment to the shocks and the magnitude of the shocks for various economies (Sato, Zhang and McAleer, 2011). To assess the monetary spillovers, we use impulse-response functions of a one-standard-deviation monetary policy shock on output, inflation, and the monetary policy rate.<sup>7</sup> The SVARs will, via, the impulse responses trace the responses of BLNS policy and macroeconomic goal variables to SA monetary policy shocks. Furthermore, the forecast error variance decompositions examine the relative importance of the monetary policy shock for fluctuations in each variable, and they indicate the forecast error variance of output, inflation, and the discount rate at different horizons that can be explained by the monetary policy shock.

### **3.2. Diebold-Yilmaz (DY) spillover measures**

The spillover index analysis is based on the approach introduced by Diebold and Yilmaz (2009; 2012). Diebold and Yilmaz (2012) define the spillovers as the share of the forecast error variances of one variable contributed by the other variable(s). According to Cotter, *et al.*, (2017), the DY spillover method summarises variance decomposition information from the SVAR, into a set of relevant and easily interpretable spillover measures. The main advantages of using the DY spillover index in this study are that (Lee, Liao, Huang and Huang, 2015):

- It provides magnitude as well as the direction of the policy spillover.
- It measures the effects of shocks to SA monetary policy on the BLNS variables as well as the net contribution of SA monetary policy to the BLNS monetary policies. It also provides the time-varying magnitudes of spillovers using the rolling window estimation.
- It also provides the time-varying sizes of spillovers using the rolling window estimation.

The DY spillover analysis has mostly been applied to measure the spillovers in financial markets (cf. Louzis, 2013; Alter and Beyer, 2013; Yarovaya, Brzeszczyński

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<sup>7</sup> The inclusion of the lending rate and the effective or rand dollar exchange rate did not improve results and, therefore, these variables were excluded from the estimated SVAR.

and Lau, 2016). However, limited research exists on the application of the DY spillover analysis to the real side of the economy (Antonakakis and Badinger, 2014; Giglio, Kelly and Pruitt, 2016; Cotter *et al.*, 2017; Cronin, 2018). This study contributes to the spillover literature above by quantifying the international monetary policy spillovers among the SACU countries using the Diebold and Yilmaz (2012) framework.

Moreover, the forecast error variance decompositions result from the SVAR framework (section 3.1 above), instead of the generalised VAR framework of Diebold and Yilmaz (2012). The SVAR model produces variance decompositions used in the construction of the spillover measures. Suppose that from the VAR framework, the  $H$ -step ahead forecast error variance decomposition is denoted by  $\phi_{ij}(H)$ . The total spillover index measures the contribution of spillovers of shocks across all countries to the total forecast error variance and can be defined as:

$$TS(H) = \frac{\sum_{i,j=1, i \neq j}^N \phi_{ij}(H)}{\sum_{i,j=1}^N \phi_{ij}(H)} \times 100 \quad (6)$$

The calculation of the directional spillovers stems from the consideration that the focus of this study is to examine the spillovers from South Africa to the BLNS countries. These directional spillovers refer to the spillover effects transmitted by SA to the BLNS country,  $j$ , denoted as:<sup>8</sup>

$$DS_{SA \rightarrow j}(H) = \frac{\sum_{j=1}^N \phi_{jSA}(H)}{\sum_{i,j=1}^N \phi_{SAj}(H)} \times 100 \quad (7)$$

Considering that a unidirectional SVAR model is specified, the directional spillover index is also unidirectional. Furthermore, the directional spillovers calculated in this article are slightly different from the ones presented by Diebold-Yilmaz (2012) because they focus only on the contribution of a subset of variables, which is the contribution of the South African variables to the BLNS country variables.

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<sup>8</sup> Note that there is another form of directional spillovers which refers to those spillover effects received by South Africa from the BLNS country,  $j$ , defined as:  $DS_{SA \leftarrow j}(H) = \frac{\sum_{j=1, i \neq j}^N \phi_{ij}(H)}{\sum_{i,j=1}^N \phi_{ij}(H)} \times 100$ . However, this directional spillover is not relevant for this study because the smaller SACU countries do not have a significant influence on South Africa.

The directional spillovers focus on the South African spillovers via the three monetary policy equations representing the direct channel (Phillips curve and interest rate pass-through) and indirect channel (monetary policy reaction function). A Phillips curve represents a relationship between inflation and output of the BLNS country, and South African inflation and GDP are included to capture the spillovers from South Africa. The calculation of the South African spillovers through each of the BLNS Phillips curves is as follows:

$$\frac{\text{Contribution to BLNS inflation by SA inflation and output}}{\text{Overall contribution of PC variables (SA + own)}} \times 100$$

Interest rate pass-through represents the proportion of South African monetary policy interest rates transmitted to rates for the BLNS country. The SA spillovers, through each of the BLNS interest rate pass-through equations are as follows:

$$\frac{\text{Contribution to BLNS monetary policy rate by SA monetary policy rate}}{\text{Overall contribution of IRPT variables (SA + own)}} \times 100$$

The direct spillovers, measured through the monetary policy reaction function, show how the BLNS country monetary policy rates react to changes in their output and price levels, with SA inflation and output included capturing the spillovers. The spillovers are as follows:

$$\frac{\text{Contribution to BLNS policy rate from SA output, inflation, and policy rate}}{\text{Overall contribution of MPRF variables (SA + own)}} \times 100$$

#### **4. DATA AND RESULTS**

The variables used in the study are quarterly and range from 1960Q1 to 2016Q4, depending on the availability of the data. The source of the data is the IMF IFS database. Gross domestic product (GDP) represents a measure of output and only South Africa and Botswana have GDP time series available quarterly. Lesotho, Namibia, and Swaziland's (LNS countries) GDP time series are on an annual basis. Because of this, the SVAR models of the LNS countries only include South African GDP as a measure of output.<sup>9</sup> Table 1 presents the data available and the period of

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<sup>9</sup> Note that the correlation and cointegration analysis of the South African and the LNS GDP series was done to show how closely linked the GDP series are. The analysis is presented in Appendix A1. Moreover, other variables

availability. Inflation is calculated as the quarter to the same quarter of the previous year percentage change in the log of a consumer price index (CPI). This method of calculating inflation brought the problem of serial correlation in the SVAR models because of overlapping quarters. However, including more lags in the model eliminated this problem. Inflation is the target of the monetary policy conducted by the central bank. Moreover, the discount and Treasury Bill (TB) rates are nominal short-term interest rates used as proxies for the monetary policy rate. The interest rates and inflation rates are in percentages. GDP is detrended using the Hodrick-Prescott filter to estimate the output gap (e.g. Dungey and Fry, 2003).<sup>10</sup>

Table 1: sample information

Variable (country)	Date	Sample size
GDP (SA)	1960Q1 – 2018Q4	236
GDP (B)	1994Q1 – 2018Q4	100
Policy rate (SA)	1960Q1 – 2018Q4	236
Discount bank rate (B)	1976Q3 – 2018Q4	170
TB rate (L)	1980Q1 – 2018Q4	103
TB rate (N)	1991Q3 – 2018Q4	110
Discount rate (S)	1976Q3 – 2018Q4	170
Inflation (SA)	1961Q1 – 2018Q4	232
Inflation (B)	1975Q1 – 2018Q3	177
Inflation (L)	1974Q1 – 2018Q3	179
Inflation (N)	2003Q1 – 2018Q3	63
Inflation (S)	1966Q1 – 2018Q4	212

Before estimating the SVARs, an optimal lag was determined using the information criteria. The Akaike Information Criteria (AIC) and the Schwarz Information Criteria (SC) identified the appropriate lag length to be between 1 and 8 lags for all the four SVAR models. The preferred lag lengths were then selected based on information criteria and the absence of serial correlation in the SVAR model.

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considered as proxies for the LNS GDP series are industrial production, manufacturing production, and formal employment. However, these variables are only available on an annual basis and not quarterly. Therefore, the SA GDP series is the only variable included in the LNS SVARs as an indicator of economic activity trend in SA and the LNS countries.

<sup>10</sup> Following the method used by Kaiser and Maravall (1999), observations were extended by 3 years (12 observations for quarterly data) at the beginning and the end of the sample in an attempt to deal with the end-of-sample problem of the HP filter method.

#### **4.1. Identification**

In identifying the structural shocks in an SVAR, some restrictions were placed on contemporaneous relationships. These restrictions necessitate a parsimonious specification as well as a stable model that fares well in terms of the diagnostic checks. As mentioned earlier, economic theory and the three monetary policy equations (the Phillips curve, interest rate pass-through and the monetary policy reaction function) guide the SVAR restrictions. The output gap is expected to have a positive relationship with inflation, which is a Phillips curve relation. If existent, the interest rate pass-through is expected to be positive in reaction to a change in the South African policy rate. Lastly, from the monetary reaction function, the policy rate is expected to have a negative response to a change in inflation and a positive response to a change in the output gap.

The process of selecting the contemporaneous restrictions involved eliminating the insignificant contemporaneous coefficients until only the significant ones remained. Therefore, the identified contemporaneous matrices for the BLNS countries are presented below. The subscripts B, L, N, S and SA refer to Botswana, Lesotho, Namibia, Swaziland, and South Africa, respectively.  $A_0$  represents the matrix of contemporaneous coefficients, and  $X$  is the vector of variables included in the SVARs. Considering that South Africa is the dominant economy and the source of the policy spillovers, its variables are ordered first in the SVAR model of all the BLNS countries. The restrictions show that the monetary policy rate reacts to contemporaneous output and inflation (domestic and foreign). However, researchers such as Kim (2001) and Sanchez-Ordóñez (2017) argue that foreign output and inflation do not enter contemporaneously into the SVAR model of monetary policy transmission analysis.

Based on literature and the three monetary policy equations, different SVAR specifications (with varying combinations of variables – R/\$ exchange rate, lending rate) were tried and tested, and the best of the restrictions were adopted.<sup>11</sup> The best SVAR models included only the monetary policy rate and the policy target variables (inflation and the output gap).

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<sup>11</sup> These are available, if requested.

The Botswana SVAR presented below consists of six variables, namely the output gap, inflation, and the monetary policy rate for South Africa and Botswana.

$$\text{Botswana} \rightarrow A_0 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 & 0 \\ b_{41} & 0 & 0 & 1 & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & 1 \end{bmatrix}; X = \begin{bmatrix} \hat{y}_{SA} \\ \pi_{SA} \\ i_{SA}^p \\ \hat{y}_B \\ \pi_B \\ i_B^p \end{bmatrix}$$

The estimation period is 1995Q3 – 2017Q4 ( $n = 90$ ) and the best model with no serial correlation is at six lags. The contemporaneous restrictions imposed for the Botswana SVAR model are that the South African output gap and inflation contemporaneously affect the SA policy rate and Botswana inflation and policy rates. The contemporaneous effects to the Botswana inflation come from the South African inflation, the South African policy rate, and Botswana output gap. Lastly, the contemporaneous restrictions for the Botswana policy rate (proxied by the discount rate) show that the Botswana policy rate is expected to respond contemporaneously to all the other variables.

The Lesotho and Swaziland SVAR models identify the same restrictions and include five variables, namely the South African output gap, inflation and monetary policy rates as well as the inflations, and the monetary policy rates for either Lesotho or Swaziland. The estimation period for Lesotho is 1987Q1 – 2018Q3 ( $n = 127$ ), while the estimation period for Swaziland is 1976Q3 – 2018Q3 ( $n = 169$ ). For both countries, the best model with no serial correlation is at six lags. Presented below is the chosen restriction for Lesotho and Swaziland:

$$\text{Lesotho/Swaziland} \rightarrow A_0 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 \\ 0 & b_{52} & b_{53} & b_{54} & 1 \end{bmatrix}; X = \begin{bmatrix} \hat{y}_{SA} \\ \pi_{SA} \\ i_{SA}^p \\ \pi_i \\ i_i^p \end{bmatrix}$$

where  $i$  is either L or S. The contemporaneous restrictions in the Lesotho/Swaziland SVARs indicate that the Lesotho/Swaziland policy rate reacts to contemporaneous South African inflation and monetary policy rates, and the Lesotho/Swaziland inflation rate.

Moreover, the Lesotho/Swaziland inflation rate is likely to respond contemporaneously to all the South African variables (output gap, inflation, and monetary policy rate).

In addition, the SVAR model for Namibia includes the output gap for South Africa and the inflation and monetary policy rates for South Africa and Namibia. The estimation period is 2004Q4 – 2018Q3 (n = 56) and the best model with no serial correlation is at six lags.

$$\text{Namibia} \rightarrow A_0 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 \\ b_{41} & b_{42} & 0 & 1 & 0 \\ b_{51} & b_{52} & b_{53} & 0 & 1 \end{bmatrix}; X = \begin{bmatrix} \hat{y}_{SA} \\ \pi_{SA} \\ i_{SA}^p \\ \pi_N \\ i_N^p \end{bmatrix}$$

The contemporaneous restrictions for the Namibia SVAR indicate that contemporaneous South African GDP and inflation rate are expected to affect the Namibian inflation and policy rate. In all the BLNS models, these restrictions indicate that SA variables can affect the BLNS variables contemporaneously, but not vice versa, which means that the SA variables do not react within the contemporaneous period to changes in any of the BLNS variables. This notion is what is expected given that South Africa is dominant in the SACU region as verified in the previous article. As highlighted above, the SVAR model restrictions build on the monetary policy equations, with the policy rate equation representing the monetary policy reaction function and the interest rate pass-through, as well as the inflation equation representing the Philips curve equation.<sup>12</sup>

Also, given that the restrictions above are non-recursive, the BLNS SVAR models became over-identified. The LR test examines the validity of this over-identification restriction. Table 2 below presents the results of these tests. The results above show that the restrictions for all the SVAR models are valid and that the residuals are uncorrelated and normally distributed.

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<sup>12</sup> The GDP equations, representing the IS function, are also included to capture a complete the monetary transmission mechanism.

Table 2: LR test and diagnostic checks

Country	LR Chi-square	Portmanteau test p-value	LM test p-value
<b>B</b>	2.746 (0.253)	0.352	0.943
<b>L</b>	2.010 (0.156)	0.512	0.367
<b>N</b>	2.301 (0.317)	0.125	0.567
<b>S</b>	0.151 (0.698)	0.463	0.326

Note: 1. LR test  $\rightarrow H_0$  is that the restrictions are valid and the values in brackets are the p-values of the Chi-square statistic for the LR test for over-identification; 2. Portmanteau and LM tests  $\rightarrow H_0$  is that the estimated SVAR model has no serial correlation; 3.  $\rightarrow H_0$  The p-values are reported.

The AR roots analysis also indicates that the estimated SVAR models are stable, because all the roots have a modulus that is less than one. Therefore, these tests mean that the impulse-responses and variance decompositions from the SVARs are valid.

#### **4.2. Impulse response analysis**

In this section, the article presents the impulse response functions of output, inflation, and the policy rate of the BLNS countries to orthogonal shocks to the South African monetary policy.<sup>13</sup> The impulse response function refers to a response of the BLNS variables to a positive one-unit shock to SA variables, i.e. one unit change of the errors measures the sizes of the shocks. This means that one-unit shocks to the monetary policy rate and inflation rate are measured as a one-percentage-point change, while a one-unit shock to output is a one percent change. The primary impulse to consider is the increase in the discount rate that represents a contractionary monetary policy. Any significant responses of BLNS variables to this monetary policy shock are an indication of direct monetary policy spillovers from SA to the BLNS country. Moreover, the impulses to SA output and inflation are also considered as an indication of indirect monetary policy spillovers.

Figure 2 shows that BLNS policy rates have a significant positive response to a one-percent South African monetary policy shock. Lesotho, Namibia and Swaziland policy rates have the most significant positive reactions to a South African monetary policy shock, and these reactions are prolonged to more than six quarters for all three countries. A one-percentage-point shock to the South African monetary policy causes

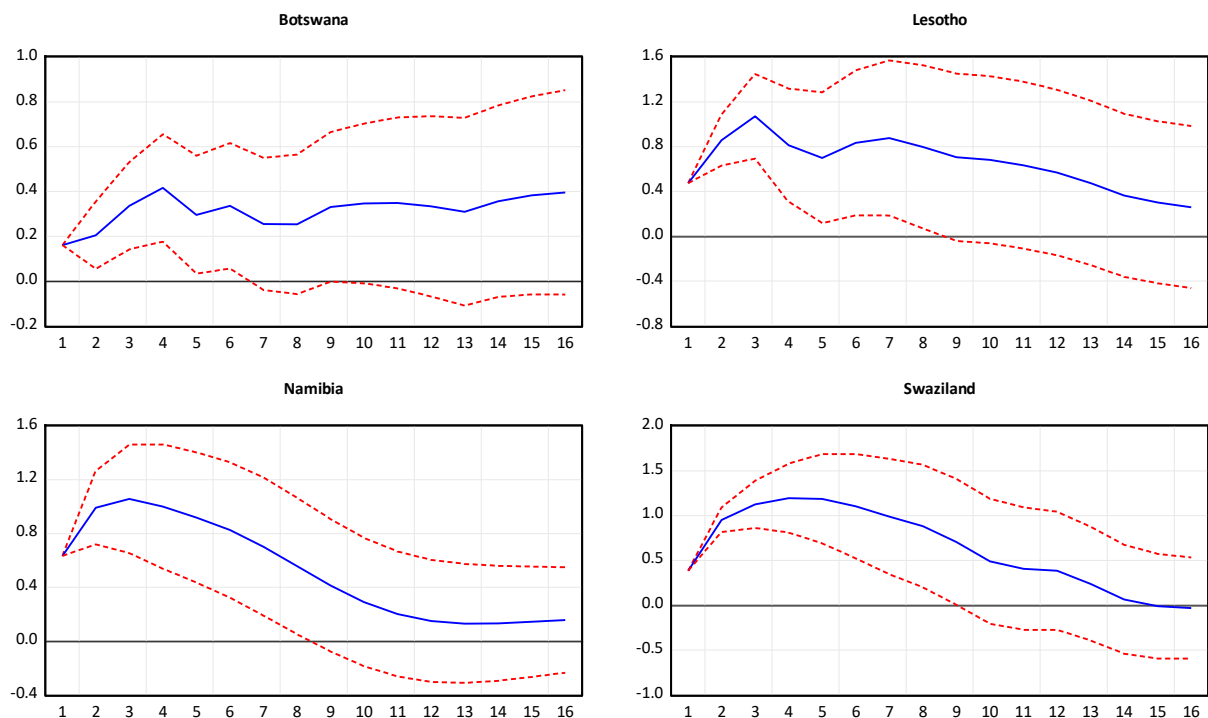
<sup>13</sup> Appendix A2 present the impulse-response functions of South African variables to their own variables and the BLNS country variables and they show that the monetary policy actions of the BLNS countries are insignificant in the South African economy. Moreover, the impulse response functions of South African variables to their own variables show a significant Philips curve relation and a monetary policy reaction function.



a 0.63 percentage-point change in the Namibian monetary policy rate in the first quarter, a 0.5 percentage-point change in the Lesotho policy rate and a 0.39 percentage-point change in the Swaziland rate. The impulse responses for these three countries peak three quarters after the monetary policy shock at an average of a one-percentage-point change, which is expected considering that the BLNS central banks follow the actions of the SA central bank closely. The positive response of the BLNS policy rates is evidence of direct monetary policy spillovers from South Africa to the other SACU countries through the interest rate pass-through, as well as proof of the South African monetary policy dominance in the SACU region.

The BLNS policy rates react in the same way South African rates respond to its monetary policy, which indicates that South African monetary policy is a relevant monetary policy for Botswana, Lesotho, Namibia, and Swaziland, and is responsible for setting the monetary policy in the region.

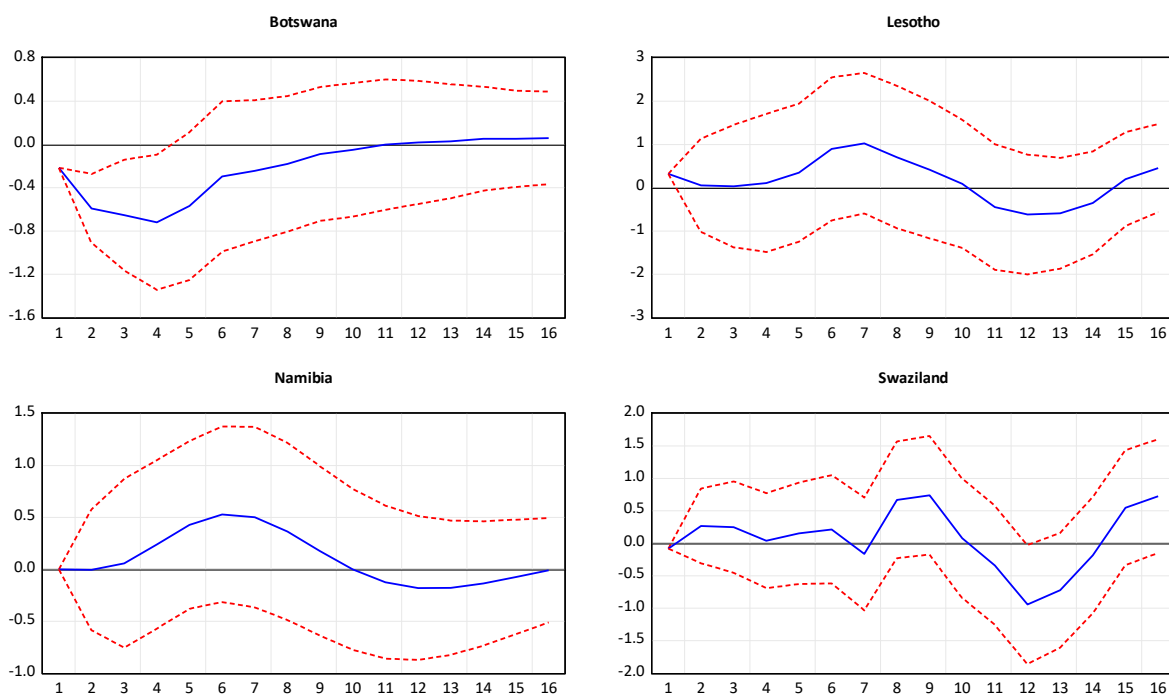
Figure 2: Response of BLNS monetary policy rates to a South African monetary policy shock (MPRF spillover)



Considering that the main objective of the central banks of the SACU countries is price stability, Figure 3 presents the impulse response functions of the BLNS inflation rates to a SA monetary policy shock.

Figure 3 shows a significant response of only Botswana inflation to a South African monetary policy shock, with insignificant responses of LNS inflation. In all the SVARs, there is an insignificant reaction of the South African inflation to its monetary policy shock. The impulse response functions of South African variables to other South African variables are available on request. A one percentage point change in the South African monetary policy rate (i.e. a shock to the South African monetary policy) triggers a decline in Botswana inflation, which lasts for nearly four quarters. The response in the first quarter is a 0.2 percentage point decline in the Botswana inflation rate, and it peaks at a 0.72 percentage point decline in the fourth quarter. However, Lesotho, Namibia and Swaziland's inflation rates have an insignificant reaction to a contraction in the South African monetary policy rate.

Figure 3: Response of BLNS inflation rates to a South African monetary policy shock



Additional monetary policy spillovers are evident from the impulse response functions of BLNS inflation to SA inflation and output shocks. These show evidence of spillovers through a Phillips curve relation. Figure 4 shows that all BLNS inflation rates have a significant positive reaction to a South African inflation shock, which is instantaneous and wears off after 4 quarters for Botswana and Lesotho and 5 quarters for Namibia and Swaziland.

A one-unit shock in the SA inflation rate leads to a peak response of 1.9 percentage points in the Lesotho inflation; 1.1 percentage points for Swaziland; 0.91 percentage points for Namibia; and 0.55 percentage points for Botswana. These findings indicate the presence of the South African inflation spillovers to the BLNS inflation variables. Moreover, monetary policy spillovers are also investigated by looking at the Phillips curve relationship between inflation and output.

Figure 4: Response of BLNS inflation rates to a South African inflation shock (PC spillover)

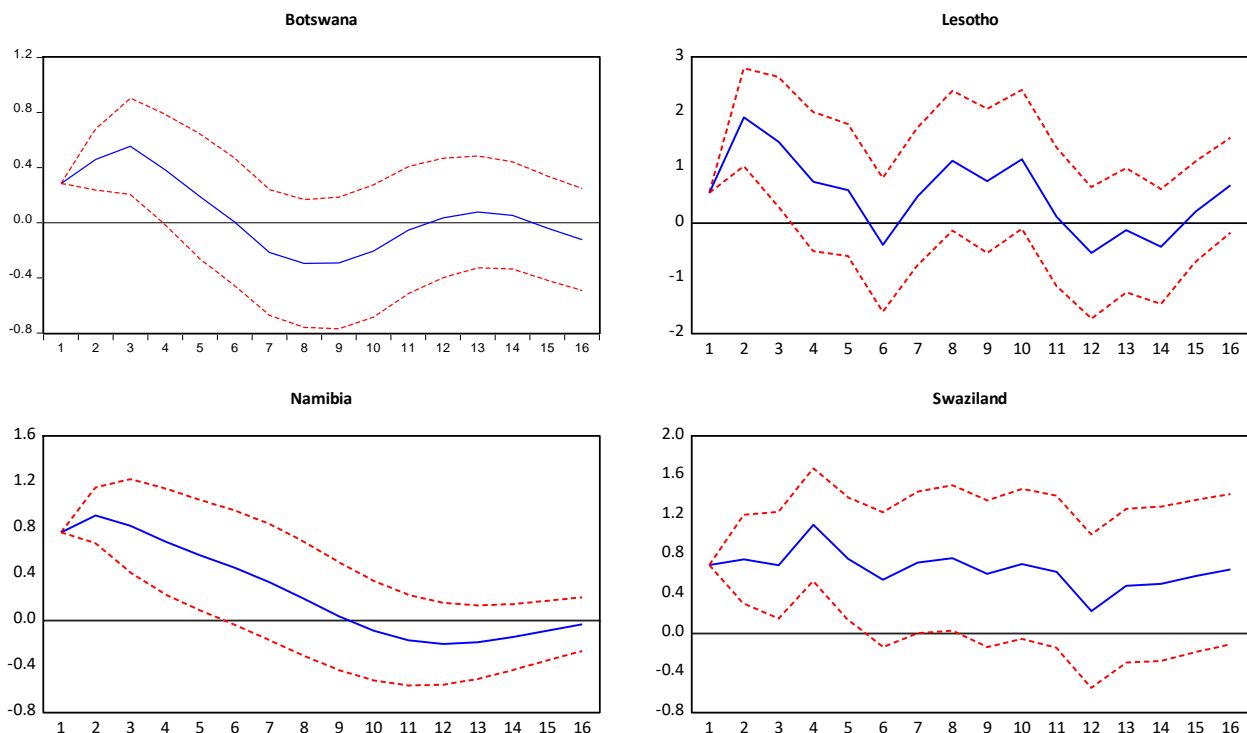
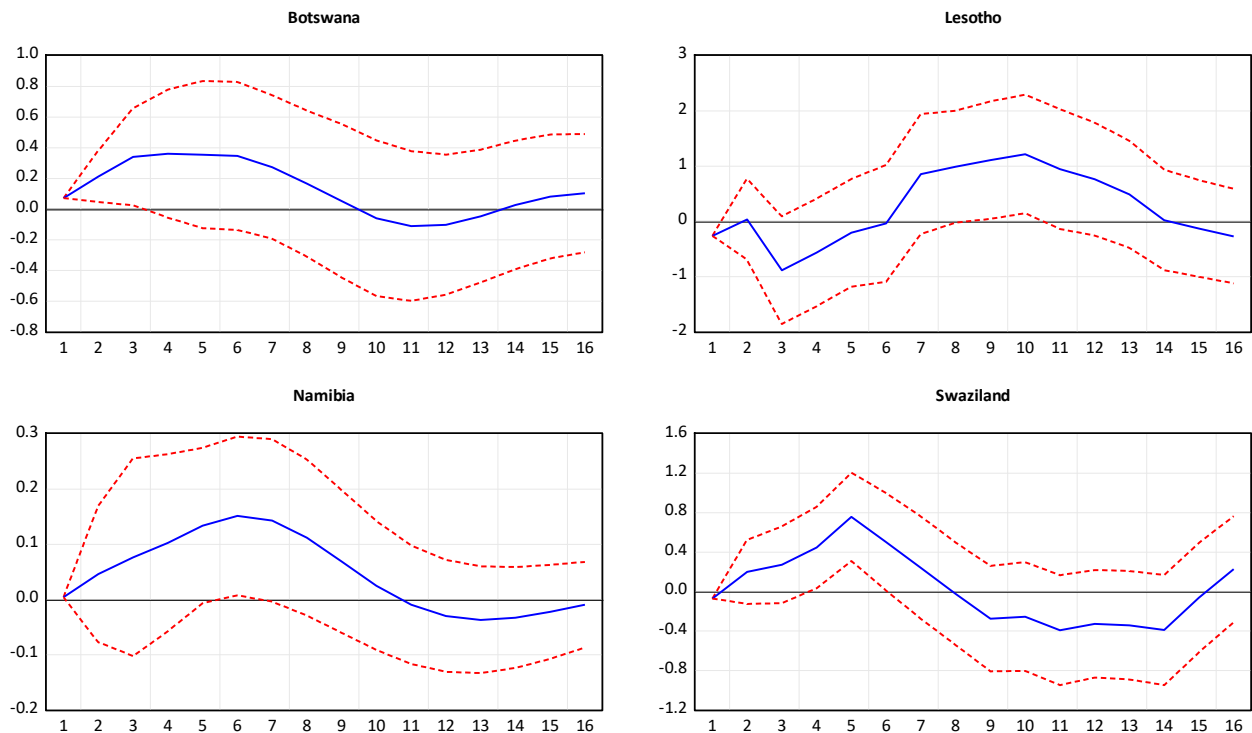


Figure 5 displays the impulse response functions of the BLNS inflation rates to a one-percent shock in the South African output. The response functions provide evidence of significant Phillips curve spillovers for Botswana, Lesotho and Swaziland where the inflation rate has a positive response to the South African output shock. The Botswana response is instantaneous, with a 0.07 percentage point in the first quarter, which peaks at a 0.34 percentage point response in the third quarter. Lesotho and Swaziland inflation rates react to a SA output shock with a lag. A slightly significant response of about 1.1 percentage-point change for Lesotho inflation is observed between the ninth and the eleventh quarter, and a significant response of about 0.7 percentage-point change between the fourth and the sixth quarters for Swaziland.

This result means that the SA output variations contribute to the monetary authority's target of stabilising inflation in Botswana, Lesotho and Swaziland. However, Namibian inflation does not react to a shock in the South African output.

Figure 5: Response of BLNS inflation rates to a South African output shock (PC spillover)



Figures 6 and 7 represent monetary policy spillovers via the monetary policy reaction function, which are spillovers of SA inflation and output on the BLNS policy rates. Lesotho, Namibia and Swaziland's policy rates have a significant reaction to a South African inflation shock. A one-percentage-point shock in SA inflation causes a 0.07 percentage-point response to Lesotho policy rate in the first quarter and this response path peaks at 0.46 in the third quarter. The responses of Namibian and Swaziland inflation rates also peak at about a 0.33 percentage-point, in the third quarter. Furthermore, all the BLNS policy rates have a significant reaction to South African output shocks. The responses become insignificant between the sixth and ninth quarters, with Swaziland having the most prolonged significant response function.

Figure 6: Response of BLNS policy rates to a South African inflation shock (MPRF spillover)

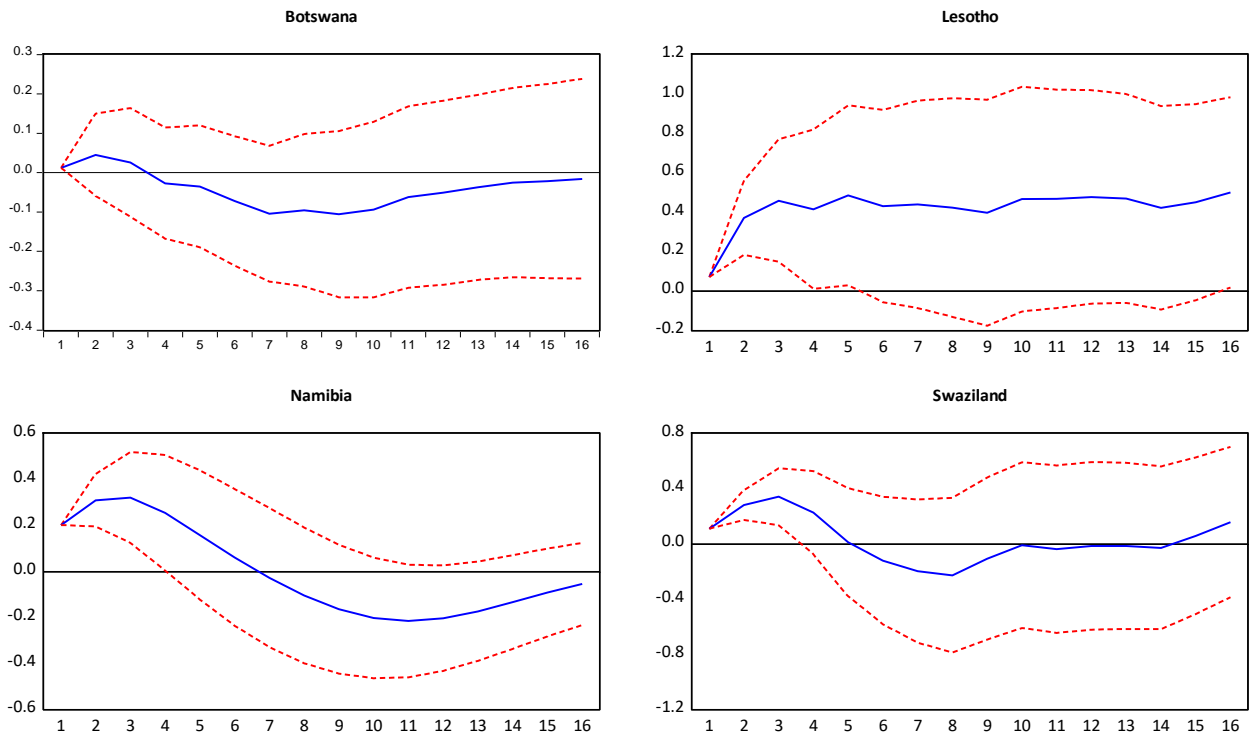
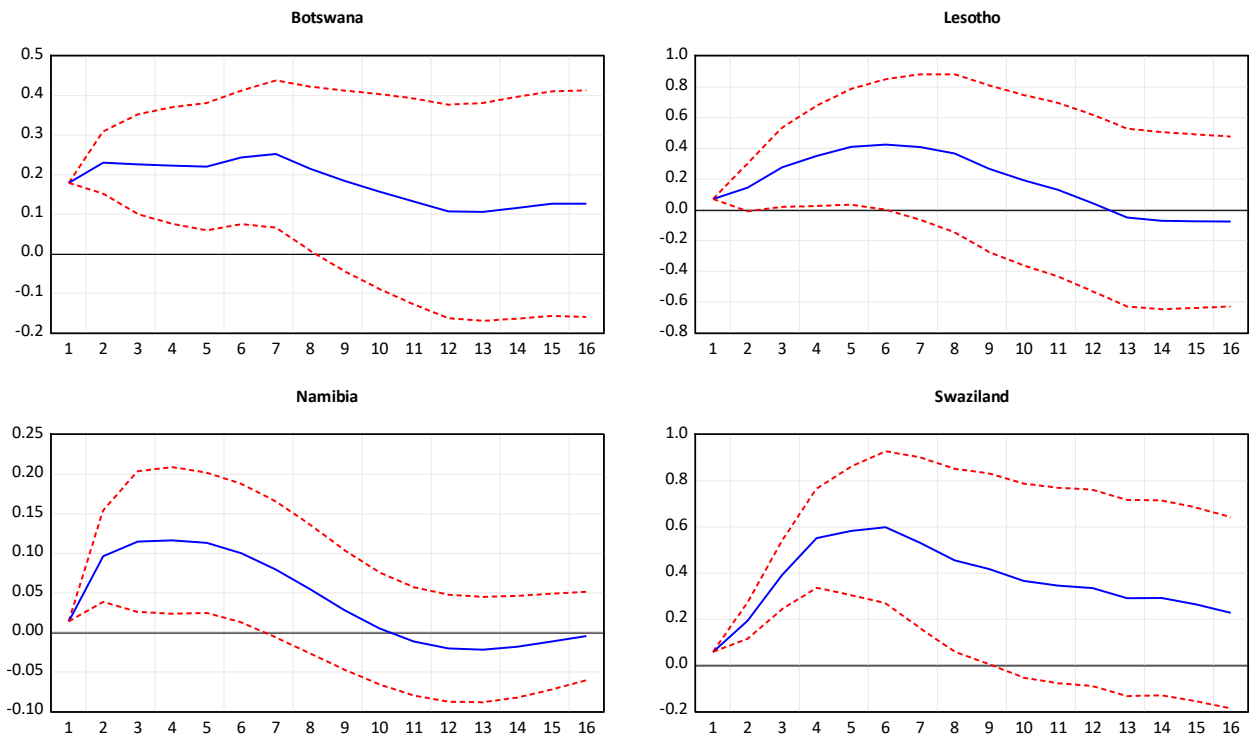


Figure 7: Response of BLNS policy rates to a South African output shock (MPRF spillover)



A one percent shock in SA output causes, in the first quarter, a 0.18 percentage-point response to Botswana policy rate; a 0.07 percentage-point response to Lesotho policy rate; a 0.01 percentage-point response to Namibia policy rate; and a 0.06 percentage-point response to Swaziland policy rate. The response paths for the BLNS countries peak at 0.25, 0.42, 0.12 and 0.06 percentage points respectively. These results show that South African inflation and output shocks have significant positive effects on the monetary policy rates of the BLNS countries, with the effects wearing off after the third quarter for the inflation shock and after six quarters for the output shock.

In summary, a South African contractionary monetary policy shock leads to a significant increase in the policy interest rates in all BLNS countries. These interest rates mainly track the South African monetary policy rate, particularly, the LNS countries, which is an indication of significant financial integration between the South African and the BLNS financial markets. Given that symmetric response to external shocks is one of the prerequisites for establishing a centralised central bank, the finding that the BLNS economies respond similarly to the South African monetary policy shocks builds the case towards setting up a SACU central bank. Moreover, these impulse response functions indicate evidence of direct and indirect monetary policy spillovers from South Africa to the other SACU countries. In addition, these results tentatively show the conclusion that the shocks to the South African monetary policy rate, inflation and output are transmitted to the BLNS monetary policy rates and inflation rates.

#### **4.3. Variance decomposition and Diebold-Yilmaz spillover analysis**

In an attempt to quantify and summarise the international spillovers, the Diebold-Yilmaz (DY) spillover measures use the variance decompositions from the SVAR models above. The variance decompositions based on the 12-step ahead forecasts (i.e. 12 quarters) and Table 3 only reports the values of the selected quarter. The variance decompositions of inflation and policy rates of the four BLNS countries from a South African monetary policy shock. Table 3 only reports the variance decompositions relating to spillovers; the rest of the variance decompositions are presented in the Appendix. The spillovers from South African variables are defined here as contributions of South African variables to the forecast error variance of the BLNS country variables.

Table 3: Variance decompositions

From → To ↓	Country	GDP (SA)	Inflation (SA)	IR (SA)	GDP (B)	Inflation (BLNS)	IR (BLNS)
GDP (SA)	B	73,47	7,92	3,08	2,2	7,86	5,47
	L	84,22	3,8	7,51		3,05	1,42
	N	76,59	5,24	9,18		2,45	6,54
	S	87,83	1,83	4,9		2,54	2,9
Inflation (SA)	B	20,2	62,02	8,1	6,53	2,05	1,1
	L	22,33	65,38	1,82		1,41	9,06
	N	12,79	81,34	2,3		0,3	3,28
	S	17,84	75,95	3,03		0,38	2,8
IR (SA)	B	37,18	15,47	42,55	2,93	1,2	0,66
	L	32,86	2,17	60,88		3,43	0,67
	N	20,23	17,43	52,18		2,33	7,83
	S	46,64	2,91	41,15		7,57	1,73
GDP (B)	B	14,23	3,84	5,25	70,41	2,42	3,85
Inflation (BLNS)	B	3,59	47,19	6,35	6,58	26,82	9,48
	L	11,55	62,75	6,07		12,21	7,42
	N	7,27	47,8	2,86		26,6	15,47
	S	12,82	50,31	5,33		23,71	7,84
IR (BLNS)	B	2,36	8,3	41,11	3,6	4,09	40,53
	L	12,25	12,09	52,75		2,07	20,83
	N	14,51	20,41	50,47		4,37	10,24
	S	31,32	2,63	38,39		9,08	18,58

The variance decomposition analysis shows that a South African monetary policy shock accounts for about 41.11% of the fluctuations in the Botswana policy rate, 52.75% of the variations in the Lesotho policy rate, 50.47% of the fluctuations in the Namibian policy rate and about 38.39% of the changes in the Swaziland policy rate. The evidence of the spillover effect of the South African monetary policy via the interest rate pass-through is, as expected, an indication of the significant dependence and integration of the LNS countries on the South African financial sector.

The South African monetary policy shock contributes a small percentage (about 2.86% – 6.35%) to the variations in the BLNS prices. There is also evidence of the contribution of South African monetary policy to BLNS prices via South African prices. The South African inflation rate accounts for 47.19% to Botswana inflation, 62.75% to Lesotho inflation, 47.80% to Namibian inflation and 50.31% to Swaziland inflation. Lastly, the South African output shocks contribute between 2.36 and 31.32% to the variations in the BLNS policy rates and between 2.63 and 20.41% to the fluctuations in the BLNS inflation rates.

The variance decomposition analysis confirms the findings from impulse response functions that the South African monetary policy shocks influence the BLNS monetary policies through their significant contributions to the fluctuations in BLNS inflation and policy rates. Furthermore, the results from the variance decomposition analysis are then summarised through the calculation of the DY spillover measures for the Phillips curve relation (PC), and monetary policy reaction function (MPRF). These spillover measures are presented in Table 4 they show that 85.89% of the South African monetary policy spills over to Lesotho inflation via inflation and output, 72.7%, 67.42%, and 60.32% spills over to Swaziland, Namibia, and Botswana prices respectively. South African own spillover indices are also calculated just for comparison with the BLNS spillover indices. The South African spillover indices are all above 90% indicating that almost all the spillovers to South Africa's Phillips curve are from own inflation and output and, therefore, South Africa is indeed dominant in the SACU region.

Table 4: Philips curve spillover measures

To ↓ From →	GDP (SA)	Inflation (SA)	Inflation (own)	Spillover Index (BLNS %)	Spillover index (SA)
<b>Inflation (B)*</b>	3.59	47.19	26.82	60.32	90.55
<b>Inflation (L)</b>	11.55	62.75	12.21	85.89	92.80
<b>Inflation (N)</b>	7.27	47.08	26.60	67.42	99.68
<b>Inflation (S)</b>	12.82	50.31	23.71	72.70	99.60

Note: Author's calculations

\* Botswana GDP has about 6.58% contribution to Botswana inflation and is not included in the table to condense the table.

Furthermore, there is evidence of South African monetary policy spillovers through the monetary policy reaction function indicated in Table 5. The spillover index to the BLNS policy rates ranges from 51.78% to 85.3%, with Botswana having the lowest spillover index and Namibia the highest index.

Table 5: Spillover measures via MPRF

To ↓ From →	GDP (SA)	Inflation (SA)	Policy rate (SA)	Inflation (own)	Policy rate (own)	Spillover index (BLNS %)	Spillover index (SA)
<b>Policy rate (B)*</b>	2.36	8.30	41.11	4.09	40.53	51.78	95.21
<b>Policy rate (L)</b>	12.25	12.09	52.75	2.07	20.83	77.10	95.90
<b>Policy rate (N)</b>	14.51	20.41	50.47	4.37	10.24	85.39	89.84
<b>Policy rate (S)</b>	31.32	2.63	38.39	9.08	18.58	72.34	90.70

Note: Author's calculations

\* Botswana GDP has about 3.60% contribution to the Botswana policy rate and is not included in the table to condense the table.



These results show that the primary source of fluctuations of the BLNS policy rates is due to South African policy spillover effects, which account for more than 50% of the variations.

Overall, the South African policy rate shocks directly spill over to the BLNS policy and non-policy variables via the Phillips curve relationship and indirectly spill over via the monetary policy reaction function. The monetary policy spillover is most substantial for policy rates in the LNS countries. The contribution of South African non-policy variables (inflation and output) to the BLNS country prices and interest rates implies that there are other spillover effects from South Africa that are not due to monetary policy shocks. Therefore, more consideration is needed from the BLNS countries when setting their monetary policies, apart from considering the SA monetary policy.

In addition, results emerging from the DY spillover measures are that South Africa is the net transmitter of monetary policy spillovers in the SACU region to Botswana, Lesotho, Namibia, and Swaziland, through the policy rate, inflation, and output. Moreover, there are significant monetary policy spillovers from SA to the BLNS countries, highlighting a high degree of integration between financial systems, and the influential role of monetary interdependencies in the SACU countries with the effects of the SA monetary policy dominating the region.

## **5. CONCLUSION AND POLICY IMPLICATIONS**

Building on the research by Aziakpono (2012) and Ikhida and Uanguta (2010) on the SACU countries, the purpose of this study is to investigate the magnitude and importance of South African monetary policy spillovers to the BLNS countries using quarterly data on the policy rate, inflation, and GDP. This is a relevant study, because there is limited empirical evidence known to the policymakers in the BLNS countries with respect to the degree and magnitude of the South African monetary policy spillovers to these economies. Methodologically, the study employs the SVAR impulse-response functions, variance decomposition analysis, and an adapted VAR-based spillover index by Diebold and Yilmaz (2012). These methods, particularly the Diebold-Yilmaz index, are well suited to the investigation and have rarely been used in the international monetary policy spillover analysis in the SACU region.

Generally, the findings are that the South African monetary policy spillovers are an essential source of fluctuations in the policy and non-policy variables of the BLNS countries. These spillovers suggest a high level of financial linkage and dependence of BLNS countries on South Africa's financial systems as well as openness and capital mobility among the SACU countries. Furthermore, a South African monetary policy shock significantly affects interest rates and inflation in the BLNS countries in a homogenous manner and largely the same way as within South Africa. Therefore, this common spillover effect of the South African monetary policy to the other SACU countries points towards the feasibility of setting up a regional central bank in the SACU region. However, there are other factors to consider as well which would contribute to making the regional central bank feasible and these include stable economic growth and an effective fiscal policy (Bawumia, 2002).

Lastly, the findings from this article have an important policy implication that South African monetary policy shocks significantly spill over to the BLNS countries, although slightly less intense for Botswana. The magnitude of spillover effects obtained in this study points towards the feasibility of setting up a supranational monetary policy as well as the importance of establishing macroprudential stabilisation policies (Antonakakis and Badinger, 2014).

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## **Appendix A – Literature review**

Table A–2.1a: Phillips curve literature

<b>Author</b>	<b>Focus of study</b>	<b>Country coverage (Sample)</b>	<b>Method</b>	<b>Phillips curve (economic activity)</b>	<b>Note</b>
Chadha, Masson, and Meredith (1992)	Focus on the output costs of disinflation	Industrial countries	Theoretical model and simulation using a global multi-region empirical model (MULTIMOD)	Phillips curve model with both forward and backward behavior (Capacity utilisation)	There is the support that inflation is determined as a weighted average of past and future expected inflation. There is limited support for a non-linear relation
King and Watson (1994)	Investigate the post-war US Phillips curve correlation	USA (1954M1 – 1993M12)	VAR techniques	Structural model of the Phillips curve (unemployment)	The traditional Phillips curve relation fits the US data well.
Laxton <i>et al</i> (1995)	Explore alternative non-linear specifications of the Phillips curve	G7 countries – pooled data (1965 – 1993)	Nonlinear estimation methods	Phillips curve model with both forward and backward behavior (output gap)	Find support for the nonlinear Phillips curve relation.
Clark <i>et al</i> (1996)	Provide implications of a non-linear Phillips curve for monetary policy	USA (1964Q1 – 1990Q4)	The calibrated small macro model	Non-linear Phillips curve (output gap)	There is evidence of a non-linear Phillips curve relationship between US inflation and output.
Debelle and Laxton (1997)	Estimate model-consistent measures of the NAIRU	Canada, the UK, and the USA	Kalman filter and maximum likelihood procedure	Both linear and non-linear model of the Phillips curve (unemployment gap)	Find that the non-linear model of the Phillips curve fits the data better than the linear
Gali and Gertler (1999)	Develop and estimate a structural model of the Phillips curve	USA (1960Q1 – 1997Q4)	GMM technique	NKPC (Real marginal cost)	NKPC approximates the dynamics of data well. Significant real marginal cost in driving inflation.

Table A–2.1a: Phillips curve literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Gali, Gertler, and Lopez-Salido (2001)	Propose and estimate a simple theory-based Phillips curve	Euro area (1970Q1 – 1998Q2)	GMM technique	Hybrid NKPC (Real unit labor costs as a proxy for real marginal cost)	NKPC holds (backward-looking behavior is insignificant)  Marginal cost based version of the new Phillips curve provides a reasonable account of the dynamics of inflation in the Euro area
Loungani and Swagel (2001)	Develop stylized facts about the inflation process in developing countries	53 developing countries (1964 – 1998)	VAR technique	Traditional Phillips curve relationship (Output gap)	The traditional Phillips curve holds and inflation in Southern African countries shows backward-looking behavior.
Sbordone (2002)	Investigate predictions of a simple optimising model of nominal price rigidity for the dynamics of inflation	USA (1960Q2 – 1997Q1)	VAR technique	NKPC (Unit labour cost)	NKPC explains the dynamics of US inflation well
Ewing and Seyfried (2003)	Determine whether or not the incorporation of time-varying volatility of inflation provides meaningful information to the standard expectations-augmented Phillips curve.	USA (1954Q3 – 1999Q2)	GARCH  GARCH-M	Time-varying expectations-augmented Phillips curve (output gap)	Inflation exhibits volatility persistence  A short-run expectations-augmented Phillips curve holds

Table A–2.1a: Phillips curve literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Fasolo and Portugal (2004)	Estimate a Phillips curve allowing for expectations with imperfect rationality	Brazil (1990Q1 – 2002Q3)	GMM technique Markov-switching model	Convex NKPC (unemployment)	There is a nonlinear relationship between inflation and unemployment.
Linde (2005)	Construct a simple macroeconomic model to estimate the NKPC	USA (1960Q1 – 1997Q4)	Full Information Maximum Likelihood (FIML) estimation	Hybrid NKPC (output gap)	Rejects the NKPC The hybrid NKPC is a reasonable representation of US inflation dynamics
Scheibe <i>et al</i> (2005)	Estimate a Phillips curve	China (1988Q1 – 2002Q4)	Instrumental variable approach	All 3 versions - traditional, NKPC and hybrid NKPC (output gap)	Backward-looking, traditional Phillips curve estimations result in stable results. Hybrid NKPC Phillips curve has the best fit for China. Changes in exchange rates are also important in explaining inflation in China.
Yazgan and Yilmazkuday (2005)	Estimate the NKPC	Turkey (1988Q2 – 2003Q1)	Nonlinear GMM estimation using Limited information	NKPC	The pure forward-looking NKPC explains well the dynamics of inflation in Turkey



Table A–2.1a: Phillips curve literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Melihovs and Zasova (2007)	To determine how expectations affect the inflation dynamics	Latvia (1996Q1 – 2006Q1)	GMM technique	All 3 versions - traditional, NKPC and hybrid NKPC: closed and open economy (unemployment gap)	Hybrid open economy NKPC best explains the core inflation dynamics in Latvia  Foreign output price changes and exchange rates are also significant determinants of inflation in Latvia
Paloviita (2008)	Examine inflation dynamics	Euro area (1990 – 2006: pooled)	GMM technique	Open economy hybrid NKPC (output gap)	The open economy hybrid NKPC specification captures the Euro area inflation dynamics well.  Additional variables that affect domestic inflation are intermediate goods, money supply, and foreign conditions.
Jensen (2010)	Estimate a hybrid NKPC	Euro is (1996Q2 – 2010Q2)	GMM technique	Hybrid NKPC (capacity utilisation)	The hybrid NKPC approximates the Euro area inflation dynamics well.
Basarac <i>et al</i> (2011)	Assess the ability of the hybrid NKPC to explain inflation dynamics	9 European transition economies (2002Q2 – 2009Q2)	Dynamic fixed effects model and PMG estimator	Hybrid NKPC (output gap)	Inflation, expected inflation, and the output gap are cointegrated.  The hybrid NKPC represents the data well in all the transition economies.

Table A–2.1a: Phillips curve literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Leshoro (2011)	To determine the causes of inflation in Kenya	Kenya (1980 – 2010)	Error-correction mechanisms	Backward-looking NKPC (real GDP growth)	The backward-looking NKPC fits the data well  Found short-run and long-run relationships between inflation and each of the following: lagged inflation, money supply, discount rate, oil prices, and real output growth.
Shahbaz <i>et al</i> (2012)	Explore the existence of the Phillips curve	North Cyprus (1978 – 2007)	ARDL bounds testing DOLS	Hybrid NKPC (unemployment)	There is a stable Phillips curve relation.
Russell and Chowdhury (2013)	To determine whether or not different versions of the Phillips curve predict inflation as an integrated or very near-integrated statistical process.	USA (1960Q1 – 2010Q4)	GARCH	GARCH hybrid Phillips curve (it incorporates the expectations-augmented, NKPC, hybrid NKPC as well as statistical process consistent Phillips curve (price series divided by the unit labour cost)	US data is consistent with the statistical process consistent Phillips curve, i.e. expectations formation that assumes agents know the statistical process of inflation.
Sahu (2013)	Examine the short-run inflation dynamics	India (1996Q1 – 2010Q4)	GMM technique	Open economy hybrid NKPC (output gap)	The hybrid NKPC provides a robust explanation of the dynamics of inflation in India. Exchange rate and foreign inflation are significant determinants of wholesale price index inflation.

Table A–2.1a: Phillips curve literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Milucka (2014)	Examine inflation dynamics	Czech Republic (2000Q1 – 2012Q4)	Kalman filter with maximum likelihood	Hybrid NKPC (output gap)	The hybrid NKPC fits the dynamics in the Czech Republic well – expected inflation dominates the lagged inflation
Ball and Mazumder (2015)	Examine the behavior of core inflation	USA (2000Q1 – 2014Q2)	Non-linear squares	Expectations-augmented Phillips curve (short-term unemployment gap)	The expectations-augmented Phillips curve explains the US inflation dynamics well.
Esu and Atan (2017)	Assess the validity of the Phillips curve hypothesis	Sub-Saharan African region – 29 countries (1991 – 2015)	Panel data technique - Fixed effects approach	Expectations-augmented Phillips curve (unemployment)	There is no existence of the Phillips curve relationship in the Sub-Saharan African region.
Kobbi and Gabsi (2017)	Check the nonlinearity of the Phillips curve	Tunisia (1993Q1 – 2012Q3)	Logistic Smooth Transition Regression	Hybrid NKPC (output gap)	There is evidence of a non-linear Phillips curve for Tunisia.

Table A-2.1b: Phillips curve literature (SACU countries)

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Nkomo (1999)	An empirical study of the determinants of the Phillips curve	South Africa (1980 – 1998)	Ordinary least squares (OLS)	Unemployment – NAIRU Price Phillips curve and Wage Phillips curve	Evidence of trade-off between price inflation and unemployment, but not for wage inflation
Hodge (2002)	Estimated a Phillips curve for SA	South Africa (1983 – 1998)	Regression analysis	Backward-looking Phillips curve (unemployment rate)	No evidence of a relationship between inflation and unemployment  Evidence of a relationship between inflation and output growth.
Fedderke and Schaling (2005)	Model inflation	South Africa (1963Q4-1998Q2)	VECM approach	NKPC	Found support for the NKPC model.
Ogbokor (2005)	Test the applicability of the short-run Phillips curve	Namibia (1991 – 2005)	OLS	Traditional Phillips curve (unemployment)	Find no support for the traditional Phillips curve.
Burger and Marinkov (2006)	Test whether or not the Gordon triangle model applies to SA	South Africa (1976Q1-2002Q2)	Regression analysis	Gordon triangle model (output gap)	Find evidence of inertia effects  Triangle model does not apply to SA
Du Plessis and Burger (2006)	Estimate a hybrid NKPC for SA	South Africa (1975Q1-2003Q4)	GMM technique	Hybrid NKPC (Labour share income)	The NKPC fits the inflation dynamics in SA.

Table A-2.1b: Phillips curve literature (SACU countries) *continued*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Nell (2006)	Re-examine the role of the Phillips curve for monetary policy analysis	South Africa (1971Q-2001Q2)	Piecewise linear regression based on the ARDL modelling approach	Expectations-augmented Phillips curve (output gap)	The linear Phillips curve accurately describe SA's inflation for the earlier period.  For the later period, a piecewise the concave curve with output gap correctly.
Chicheke (2009)	Investigate the relationship between inflation and unemployment as explained by the	South Africa (1980-2008)	VECM – apply a minimum likelihood estimation	Traditional Phillips curve (unemployment)	There is a long-run relationship between inflation and unemployment.
Dadam and Viegi (2015)	Study the relationships between wage inflation and employment conditions in SA	South Africa (1970Q1-2013Q4)	Pool mean group estimation	Aggregate NK wage Phillips curve	Wages do not respond strongly to labour market conditions
Khumalo and Eita (2015)	Investigate macroeconomic determinants of unemployment	Swaziland	Engle-Granger step procedure	Phillips curve relationship (unemployment)	There is an insignificant relationship between unemployment and inflation in Swaziland.
Reid and du Rand (2015)	Estimate sticky information for SA	South Africa (2000Q3-2010Q4)	GMM technique	Sticky information Phillips curve (output gap)	There is a long-run relationship between inflation and unemployment.

Table A-2.1b: Phillips curve literature (SACU countries) *contd*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Kabundi, Schaling and Some (2016)	Estimate a Phillips curve for SA	South Africa (1994Q1-2014Q1)	Bayesian methods using a Markov chain Monte Carlo algorithm.	Bounded random walk model of the Phillips curve (unemployment rate)	Find that the slope of the Phillips curve has flattened. Inflation persistence is time-varying.
Leshoro and Kollampara (2016)	Test the existence of the Phillips curve in South Africa	South Africa	Fully-modified OLS and GMM techniques	Hybrid NKPC (output)	A stable Phillips curve does not exist in South Africa.
Phiri (2016)	Investigates the asymmetric behavior in the SA Phillips curve relation	South Africa (1970Q1-2014Q1)	Logistic smooth transition regression	All 3 versions: traditional Phillips curve; NKPC and hybrid NKPC (marginal cost and output gap)	The hybrid NKPC fits the SA data well.
Shifotoka (2015)	Find out whether the Phillips curve is applicable	Namibia (1961 – 2012)	VAR, VECM and Granger causality	Traditional Phillips curve (unemployment)	Confirms the existence of the Phillips curve in Namibia.
Ngalawa and Komba (2017)	Establish whether the country's Phillips curve is symmetric or not	South Africa (2000Q3-2015Q1)	GMM technique and NK DSGE model calibrated on SA data	Expectations-augmented Phillips curve (output gap)	Find that the Phillips curve in SA is asymmetric and concave.
Sediakgotla (2017)	Investigate inflation dynamics	Botswana (2005Q1-2015Q1)	GMM technique	Hybrid NKPC (non-mining output gap)	Find support for the hybrid NKPC in Botswana Also, find that exchange rates are a significant determinant of inflation.

Table A-2.1b: Phillips curve literature (SACU countries) *contd*

Author	Focus of study	Country coverage (Sample)	Method	Phillips curve (economic activity)	Note
Vermeulen (2017)	To test the existence of the Phillips curve	South Africa	Engle-Granger error-correction framework	Gordon's triangle model	<p>In the short-run, there is no Phillips curve relation.</p> <p>There is a significant negative relation between inflation and employment rate, in the long-run.</p>

Table A-2.2a: Interest rate pass-through literature

Author	Focus of study	Country coverage (Sample)	Method	Note
Borio and Fritz (1995)	A cross country analysis of pass-through of lending rates to changes in policy rates	Australia; Belgium; Canada; France; Germany; Italy; Japan; Netherlands; UK; USA Early 1984 – End 1994	OLS regression (error-correction form)	Find symmetric responses There is complete pass-through within 2 years for all countries.
Mojon (2000)	Analyse the interest rate pass-through of money market rates to retail rates and examine how it has evolved over time	Euro area (6 countries) – Belgium; France; Germany; Italy; Netherlands; Spain 1979 – 1998	Panel data – error-correction model	Pass-through differs across countries and across markets. The higher the volatility of the policy rate, the lower the pass-through.
Donnay and Degryse (2001)	Estimate the interest rate pass-through from the money market to lending rate and government yield.	European countries (Germany; France; Spain; Netherlands; Italy; Belgium; Ireland; Portugal) 1980 – 2000	Structural vector autoregressive (SVAR) (Cholesky decomposition)	Asymmetric lending rate pass-through On average, about half of the pass-through is completed within a year.
De Bondt (2002)	Investigate retail bank interest rate pass-through	Euro area 1996M1 – 2001M5	The error-correction mechanism (ECM)	Incomplete (50%) pass-through in the short-run There is evidence of quicker pass-through since the introduction of the common currency
Heinemann and Schuler (2002)	Focus on interest rate pass-through as a way of quantifying the potential benefits of increased integration in financial markets.	European monetary union (EMU) countries (11) 1995M3 – 2000M10	Cointegration analysis	Evidence of slow and asymmetric interest rate pass-through.



Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Toolsema, Sturm and De Haan (2002)	Examine the evolution of monetary policy pass-through measures and the extent of convergence of pass-through	EMU countries (Belgium; France; Germany; Italy; Netherlands; Spain) 1980M1 – 2000M1	Fully modified OLS (FM-OLS) estimation ECM framework with a moving window	The EMU countries show differences in pass-through There is weak evidence of convergence of interest rate pass-through
Wrobel and Pawlowska (2002)	Macroeconomic effects of a monetary policy shock - Interest rate pass-through within an analysis of the monetary transmission	Poland 1995M1 – 2002M3	Panel data (ECM form) SVAR (recursive and non-recursive restrictions)	Smaller and slower responsiveness of Polish CPI index and output than in the Euro area. Interest rate shocks affect inflation Incomplete short-term interest rate pass-through and complete pass-through in the long-run
Hofmann and Mizen (2004)	Examine the interest rate pass-through and monetary transmission	UK 1985M1 – 2001M12	Non-linear switching model with ECM	Asymmetric pass-through in retail rates Incomplete nonlinear pass-through Nonlinearities increase the speed of pass-through of retail rates to official rates
Horvath, Kreko, and Naszodi (2004)	Analyse the interest rate pass-through from money market rates	Hungary 1997M1 – 2004M4	Panel data analysis (ECM and Threshold autoregressive (TAR) models)	Complete and quick pass-through of corporate loan rate to short-term money market rates Incomplete pass-through of deposit rates

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Sander and Kleimeier (2004)	Investigate the interest rate pass-through from retail bank interest rates	Central and Eastern European (CEE) countries 1993M1 – 2003M12	TAR models	There is faster and more complete pass-through in CEEs than in the Euro area  There is a high potential for convergence when the CEE countries join the Euro area.
Tieman (2004)	Test the interest rate pass-through from policy interest rates to market rates and inflation	Romania 1995M1 – 2004M2	ECM framework	Interest rate pass-through is in line with that in other countries in the region and it has become more pronounced over time.
De Bondt (2005)	Investigate the pass-through of official interest rates to the long-term market interest rate.	Euro area 1996M1 – 2001M5	Vector ECM (VECM) framework	Complete pass-through of official interest rate to short-term money market interest rates  Incomplete immediate pass-through of market interest rate to deposit and lending rates.
Crespo-Cuaresma, Egert, and Reininger (2006)	Look at the interest rate pass-through of monetary policy rate via market rates to retail rates.	CEE countries (Czech Republic; Hungary; Poland; Slovakia; Slovenia) and Euro area (Austria; Germany; Spain) 1994M1 – 2005M12	Multivariate VAR (MVAR)	Pass-through is very low for overnight deposit rates  Lending rates are much more responsive to changes in the policy rate than deposit rates.
Egert and MacDonald (2006)	Investigate the interest rate pass-through	CEE countries and Euro area countries (Spain; Austria; Germany) 1994M1 – 2005M12	MVAR  Johansen cointegration framework	Evidence of declining pass-through over time

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Hofmann (2006)	Examine the pass-through of money market rates to short-term and long-term business lending rates.	Euro area (Germany; France; Italy; Spain) 1984 – 2003 (EMU and pre-EMU)	Cointegration analysis (VECM)	Since the start of the EMU, there is higher pass-through of money market rates EMU lending rates.  Conclude that pass-through of policy rates to business lending rates is an important link in the monetary transmission mechanism in the euro area.
Sander and Kleimeier (2006)	Investigate the similarity of the interest rate pass-through for countries that joined the EU and explore the potential for convergence of interest rate pass-through.  Argument – “single currency could act as a unifying force that has the potential to make the pass-through faster, more complete and more homogeneous (page 406).	CEE countries (Czech Republic; Estonia; Hungary; Latvia; Lithuania; Poland; Slovak and Slovenia) 1993M1 – 2003M12	VAR and cointegration analysis – allowing for asymmetric and threshold adjustment  TAR	On average, pass-through in CEE countries is faster and more complete than in the overall Eurozone.  No convergence of CEE pass-through towards the eurozone.
Sorensen and Werner (2006)	Do a cross-country comparison of the pass-through of market rates to bank interest rates.	Euro area (10 countries) 1999M1 – 2004M6	Panel unit root and cointegration (Dynamic seemingly unrelated regression methods)	Incomplete pass-through of bank rates to changes in market rates.  Large differences in pass-through of market rates to bank rates.

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Aziakpono, Kleimeier, and Sander (2012)	Use interest rate pass-through to examine the extent of bank market integration  Interest rate pass-through from national and South African central bank interest rates onto national retail rates.	SADC countries	Principal component analysis  ECM	Evidence of monetary integration in lending and deposit rates.  Conclude that a few SADC countries have the potential to become part of the CMA.  Increased integration is when monetary policy rates are transmitted to retail rates in a similar way in various countries.
Blot and Labondance (2010)	Investigate the effect of the financial crisis on the bank interest rate pass-through.	Euro area (11 countries)  2003M1 – 2010M5	Panel approach - Seemingly unrelated regression (SUR) ECM	The financial crisis led to lower pass-through and increased differences in pass-through among eurozone countries.
Karagiannis, Panagopoulos, and Vlamis (2010)	Examine the interest rate pass-through as a way of evaluating the efficiency of the monetary policy after the financial crisis	Eurozone (1998M1 – 2003M9)  USA (1994M1 – 2007M9)	Disaggregated general-to-specific (GETS) methodology	Complete long-run pass-through for both the Euro area and the US.  The financial crisis affected the efficiency of monetary policy
Bernhofer and Van Treeck (2013)	Analyse the pass-through of market interest rates to bank retail rates.	Euro area  1999M1 – 2009M11	Single equation ECM  Pooled mean group (PMG) estimator	Significant differences in interest rate pass-through among eurozone countries and the effectiveness of interest rate pass-through has not improved since the inception of the EMU.

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Misati, Nyamango and Kaman (2011)	Examine the degree of pass-through of monetary policy interest rates to long-term interest rates	Kenya 1993M7 – 2010M9	ARDL  Engle-Granger 2 step procedure	Incomplete pass-through (short-run and long-run)  This poses challenges for monetary policy implementation and transmission to final target variables.
Aristei and Gallo (2014)	Analyse the pass-through of interbank rates to the retail rate during the financial crisis	Euro area 2003M1 – 2011M12	Markov-switching VAR (MS-VAR)  Markov-switching VECM (MS-VECM)	During the financial crisis, pass-through decreased i.e. weakened the short-run transmission of interbank rates to retail rates.
Beckmann, Belke, and Verheyen (2012)	Investigate the issue of a nonlinear interest rate pass-through from money market rates to various lending rates	EMU countries (12) 2003M1 – 2011M9	Nonlinear cointegration techniques (logistic smooth transition regression (STR) and exponential STR)	Incomplete pass-through  There are significant differences in the size of the pass-through among the EMU countries.
Petrevski and Bogoev (2012)	Investigate the effectiveness and stability of interest rate pass-through in a small open economy with a fixed exchange rate	Macedonia 2002 – 2010	Dynamic OLS  ARDL model	Low and incomplete short-run pass-through and almost complete pass-through in the long-run  Incomplete pass-through implies an interest rate channel is not the effective transmission mechanism of domestic monetary policy.
Creel, Hubert, and Viennot (2013)	Assess how the European central bank (ECB) monetary policy is transmitted to interest rates	Euro area (4 largest)	SVAR	Significant pass-through from the ECB rate to money market interest rates, deposit rates, and lending rates.

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Micallef, Rapa and Gauci (2016)	Estimate pass-through of official interest rate to the retail bank deposit and lending rates	Malta 2000M1 – 2012M12	ARDL	Evidence of incomplete pass-through  Cross-country comparisons show significant differences in pass-through among Euro area countries.
Paries, Moccero, Krylova, and Marchini (2014)	Assess the pass-through of the ECB rate to lending rates during the financial and sovereign debt crisis	Euro area (4 largest) countries 2003M1 – 2013M12	DSGE model	ECB policy rate has not been fully transmitted to bank lending rates.
Avouyi-Dovi, Horny, and Sevestre(2017)	Examine the pass-through of the bank's marginal cost to bank lending rates	Euro area countries 2003M1 – 2014M10	A Bayesian framework, using Markov Chain Monte Carlo method  VAR model	Pass-through varies with time  Slower pass-through to lending rates in the long-run  Heterogeneous pass-through from one country to another.
Borstel, Eickmeier, and Krippner (2015)	Interest rate pass-through of the monetary policy rate to bank lending rates – during the sovereign debt crisis	Euro area 2000M1 – 2013M13	Factor-augmented VAR (FAVAR)	No change in the pass-through of monetary policy to bank lending rates, during the sovereign debt crisis
Mansour, Heller, Labidi, and Lahiani (2015)	Analyse the effects of the financial crisis on the long-run pass-through of money market rates to lending and deposit rates.	Euro area (8 countries) 2003M1 – 2014M2	Phillips and Loretan approach for cointegration	Financial crisis magnifies the heterogeneity (divergences) of the interest rate pass-through.

Table A-2.2a: Interest rate pass-through literature *continued*

Author	Focus of study	Country coverage (Sample)	Method	Note
Sevcech (2015)	Estimate the interest rate pass-through	Slovakia 2004M1 – 2013M12	ECM framework	More complete pass-through in the long-run  The financial crisis decreased the pass-through
Gregor and Melecky (2018)	Investigate the extent and stability of monetary policy rate to the lending rate	Czech Republic 2004M1 – 2017M11	ARDL modelling approach	Significant and complete pass-through for lending rate

Table A-2.3a: Monetary policy reaction functions literature

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
McNees (1992)	Estimate a forward-looking monetary policy reaction function	USA (1970Q3 – 1992Q2)	The federal fund's reaction function	The unemployment rate, inflation, real GDP growth, and M1 growth rate	The unemployment rate, real GDP growth, and M1 growth rate are statistically significant.
De Brouwer and O'Regan (1997)	Evaluate simple monetary policy rules	Australia	Taylor rule Small open economy model (calibration)	Output, prices, unit labour costs, real exchange rate, import prices, world output, world prices, terms of trade, world interest rate	The Taylor-rule fits the Australian data better.
Clarida, Gali, and Gertler (1998)	Estimate monetary policy reaction functions	Germany, Japan, USA, UK, France, and Italy (1979M4 – 1993M12)	The forward-looking monetary policy reaction function GMM technique	Inflation, money supply, Fed Funds rate, real exchange rate, the output gap	Find support for a forward-looking reaction function. Fed Funds rate, exchange rate, and monetary aggregates are insignificant.
Mehra (1999)	Estimate a forward-looking monetary policy reaction function	USA (1960Q2 – 1998Q2)	The forward-looking monetary policy reaction function GMM technique	Inflation, expected future inflation, expected output gap and bond rate	Find support for the forward-looking Taylor rule specification
Clarida, Gali, and Gertler (2000)	Estimate a forward-looking monetary policy reaction function	USA (1960Q1 – 1996Q4)	The forward-looking monetary policy reaction function GMM technique	Expected inflation gap, output gap, and lags of interest rate	The Federal Reserve raised real and nominal short-term interest rates in response to higher expected inflation.



Table A-2.3a: Monetary policy reaction functions literature *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Huang and Shen (2001)	Estimate a monetary policy reaction function	Taiwan	The monetary policy reaction function Narrative and Bayesian approach	Inflation and economic growth rate	Monetary policy responds to the inflation rate, but not to the economic
Sanchez-Fung (2000)	Estimate a hybrid monetary policy base reaction function	Dominican Republic (1969 – 2000)	Taylor-type monetary policy reaction function OLS estimation	Exchange rate differential, output gap, inflation gap	Exchange rate differentials are significant and the output gap is not.
Ping and Xiong (2003)	Examine monetary policy in the framework of the Taylor rule	China (1992Q1 – 2001Q4)	Taylor rule GMM technique	Inflation gap, output gap, long-run equilibrium nominal rate.	Taylor rule provides a useful benchmark for measuring monetary policy in China
DeBrouwer and Gilbert (2005)	Assess the stability of Australian monetary policy in the post-float period	Australia (1984Q2 – 2002Q3)	Taylor rule; backward and forward-looking monetary policy reaction function GMM technique	Inflation, output gap	Inflation dominates the output gap in the reaction function
Santacreu (2005)	Estimate reaction functions by looking at the role of nontraded inflation	New Zealand (1992Q1 – 2004Q4)	A structural general equilibrium model Bayesian techniques for DSGE models	Inflation, output gap, terms of trade, nominal exchange rate changes, foreign output, foreign inflation, foreign interest rate	Monetary policy responds directly to inflation and output gap but not to exchange rates.

Table A-2.3a: Monetary policy reaction functions literature *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Rotich, Kathanje, and Maana (2007)	Examine the conduct of monetary policy	Kenya (1998M10 – 2006M12)	Backward and forward-looking monetary policy reaction function with a monetary base instead of interest rate  GMM technique	Inflation gap, expected inflation, exchange rate, and the output gap	Inflation gap, expected and lagged inflation, output gap and exchange rate are significant in the monetary policy reaction function.
Inoue and Hamori (2009)	Estimate India's monetary policy reaction function	India (1998M04 – 2007M12)	Taylor rule (has spillovers)  Dynamic OLS	The output gap, inflation, exchange rate	Output gap and exchange rate are significant but not inflation.
Moura and Carvalho (2010)	Examine the conduct of monetary policy	7 Latin American countries – Mexico, Brazil, Chile, Peru, Colombia, Venezuela and Argentina (1999M01 – 2008M01)	Taylor-types - Different specifications of the Taylor rule  OLS with Newey-West robust standard errors	Inflation, output gap and exchange rate	A Taylor-rule specification captures the behavior of policy interest rates well in the 7 Latin American countries  The exchange rate is significant for Mexico
Sutherland (2010)	Examine monetary policy reaction functions	OECD	Taylor rule  Bounds testing approach of the ARDL modelling	Expected inflation, the output gap	For some countries, interest rates only react to changes in expected inflation while the output gap is insignificant. While in some, interest rates react to both expected inflation and the output gap.

Table A-2.3a: Monetary policy reaction functions literature *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Arbatli and Moriyama (2011)	Analyse inflation, output dynamics, and monetary policy.	Egypt (2005Q3 – 2010Q2)	Taylor-type reaction function (small open economy model) Regularised maximum likelihood (Bayesian-like method)	The output gap, expected inflation gap	There is a significant response of nominal interest rates to inflation and output gap
Boeckx (2011)	Estimate monetary policy reaction functions	ECB (1999 – 2010)	Discrete choice method	Expected growth and expected inflation	There is a significant response of nominal interest rates to expected growth and expected inflation
Girardin, Lunven, and Ma (2013)	Aim to shed light on the evolving role of inflation in the conduct of monetary policy	China (1995M1 – 2011M6)	The monetary policy reaction function Bayesian method	Inflation (expected and lagged), the output gap	Inflation and output gap are significant
Hofmann and Bogdanova (2012)	Estimate a simple Taylor rule	Advanced and emerging market economies (2000Q1 – 2012Q1)	Taylor rule Non-linear least squares	Inflation gap and the output gap	Taylor rule relation holds
Roskelley (2016)	Evaluate the predictive relationship between bond yields and the policy rate	USA (1983Q1 – 2014Q4)	Taylor-type rule Principal component analysis and regressions based on Newey-West standard errors	Inflation, output gap and principal components of bond yields	The principal components improve the Taylor rule fit Inflation, output gap and the principal components are significant.

Table A-2.3b: Monetary policy reaction functions literature (SACU countries)

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Bleaney and Lisenda (2001)	Estimate a central bank interest rate reaction function	Botswana (1992M1 – 1999M12)	Taylor-type reaction function (has spillovers) OLS Regressions	Interest rate lags, CPI inflation, credit to private sector gap, exchange rate gap, SA discount rate	The countercyclical response of the bank rate to real private sector and inflation.  Real exchange rate and SA interest rates are insignificant.
Aron and Muellbauer (2002)	Analyse the conduct of monetary policy by the South African Reserve Bank (SARB)	South Africa (1986Q2 – 1997Q4)	Taylor-type reaction function Description of historical records Instrumental variable technique	CPI deflator, output gap, US interest rate, exchange rate, balance of payments effects, money growth gap	Lagged, current and expected inflation and the output gap are significant predictors of interest rates
Uangata and Ikhide (2002)	Examine the interest rate and the credit channels of monetary policy transmission	Namibia (1990M01 – 1999M12)	Monetary policy interest rate and credit channels Cumulative Forecast error VAR technique	Private investment, consumer prices, lending rates, the repo rate, and money supply.	The significant response of lending rates, investment, consumer prices to changes in interest rates.
Woglom (2003)	Determine whether or not the adoption of inflation-targeting policy has affected the conduct of monetary policy	South Africa (1990Q1 – 2002Q4)	Taylor-type reaction function Newey West estimation technique	Inflation, output gap, exchange rate	SA's monetary policy can be represented by an implicit Taylor rule.  Real exchange rate plays a less significant role in monetary policy formulation.

Table A-2.3b: Monetary policy reaction functions literature (SACU countries) *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Setlhare (2004)	Examine the conduct of monetary policy in Botswana	Botswana (1977 – 2000)	Taylor-type monetary reaction function (has spillovers) GETS modelling	Inflation, real exchange rate, output, M1, M2, domestic private credit and total revenue from diamond sales	Inflation, directly and indirectly via the real exchange rate, is the ultimate variable of interest.  Real exchange rate and SA interest rates are significant
Matlanyane (2005)	Assess existing and alternative macroeconomic policies	Lesotho (1980 – 2000)	Macro-econometric model (Taylor rule incorporated) Engle-Granger 2 step cointegration technique	Inflation, real GDP, Treasury bill (TB) rate, SA interest rate	The economy of Lesotho is highly vulnerable to external shocks.  The TB rate is linked to national real economic activity, inflation, and SA interest rate.
Kganetsano (2007)	Examine the transmission mechanism of monetary policy	Botswana (1984Q1 – 2004Q4)	Narrative approach; VAR technique Structural approaches	Inflation, credit to private sector gap, exchange rate gap	Monetary policy in Botswana affects real output and inflation
Ortiz and Sturzenegger (2007)	Estimate the SARB's policy reaction function	South Africa (1960Q1 – 2006Q4)	Taylor-type reaction function The general equilibrium DSGE model	Inflation, output gap, nominal effective exchange rate	Find a stable rule for SARB  Inflation has a higher weight than the output gap and lowest on the exchange rate.
Manyabeza and Motlaleng (2008)	Examine the Bank of Botswana's monetary policy reaction function	Botswana (1980 – 2005)	Taylor-type reaction function VECM and impulse response analysis	Inflation gap, output gap, Rand-pula exchange rate	Botswana bank rate responds positively to a shock to the inflation gap and the output gap.

Table A-2.3b: Monetary policy reaction functions literature (SACU countries) *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Fleermuys (2010)	Assess the Namibia monetary policy to determine whether or not the Bank of Namibia considers the economy when setting the bank rate	Namibia (2000Q1 – 2009Q2)	Taylor-type reaction function Newey-west estimation technique	Inflation, real GDP, SA producer price index, crude oil, international reserves, total credit extension	The strong positive relationship between bank rate and inflation The insignificant relationship between bank rate and the output gap
Naraidoo and Raputsoane (2010)	Determine whether or not there are 'asymmetries' in the response of interest rate changes to inflation and/or output.	South Africa (2000M1 – 2008M12)	Nonlinear Taylor-type policy reaction function GMM technique	Inflation, output gap and a financial index	Symmetric response of interest rate to inflation and asymmetric response towards the output. The financial index is also an important determinant of the interest rate. Nonlinear Taylor rule fits the data well
Naraidoo and Gupta (2010)	Model monetary policy	South Africa (1983Q1 – 2007Q4)	Nonlinear Taylor-type policy reaction function Nonlinear least squares	Inflation, output gap and nominal effective exchange rate	Non-linear response of monetary policy to inflation
Ncube and Tshuma (2010)	Investigate the monetary policy conduct	South Africa (1976Q1 – 2008Q4)	Nonlinear Taylor rule A logistic smooth transition regression approach	TB rate, inflation, output gap, and real exchange rate	Nonlinear Taylor rule holds Inflation, output gap and real exchange rate are significant.

Table A-2.3b: Monetary policy reaction functions literature (SACU countries) *continued*

Author	Focus of study	Country coverage and Sample	Model and Method	Variables included	Note
Munyengwa (2012)	Examine the effectiveness of monetary policy	Botswana (1995Q1 – 2009Q4)	All monetary policy transmission channels Recursive VAR methodology	Real GDP, inflation, nominal effective exchange rate, SA inflation, M2, total commercial bank credit	Inflation, output and money supply respond to monetary policy interest rate.
Kamati (2014)	How the monetary policy affects the Namibian economy	Namibia	Transmission mechanism (has spillover) Structural VAR Bayesian methods	Real GDP, inflation, bank credit, SA interest rate spread	Inflation, unconditional inflation, econ growth rate, interest rate volatility, risk premium and SA spread are significant in explaining changes in Namibian interest rates

## **Appendix B – GDP argument**

The LNS GDP growth rates are related to SA GDP growth rate as presented in the tables below.

Table B1: Correlations between SA GDP growth rate and LNS GDP growth rates

Variables		Correlation	p-value	n
SA	L	0,971	0,000	53
	N	0,927	0,000	31
	S	0,960	0,000	51

The correlation coefficients in Table B1 show that the South African GDP growth rate is highly correlated with the LNS GDP growth rates and the correlations are statistically significant. Given that the sample size is small (n = 31 to 51), the Spearman rank correlation coefficient is used instead of the ordinary correlation coefficient. After establishing the correlations, the Johansen Fisher cointegration test was used to determine whether or not South African GDP is cointegrated with the LNS GDP. The panel form of the test was used because the sample sizes for the individual LNS GDPs are small. The LNS GDPs were pooled together and then tested for cointegration with SA GDP.

Table B2: Johansen Fisher panel cointegration test between SA GDP and LNS GDPs

Trace test	p-value	Lag	Trend assumption
82.763	0.000	1	Intercept (no trend) in the cointegrating equation and test VAR

In addition to the cointegration test, panel causality tests were also performed and the results show that SA GDP does Granger cause LNS GDP.

Table B3 : Causality tests between GDP growth rates

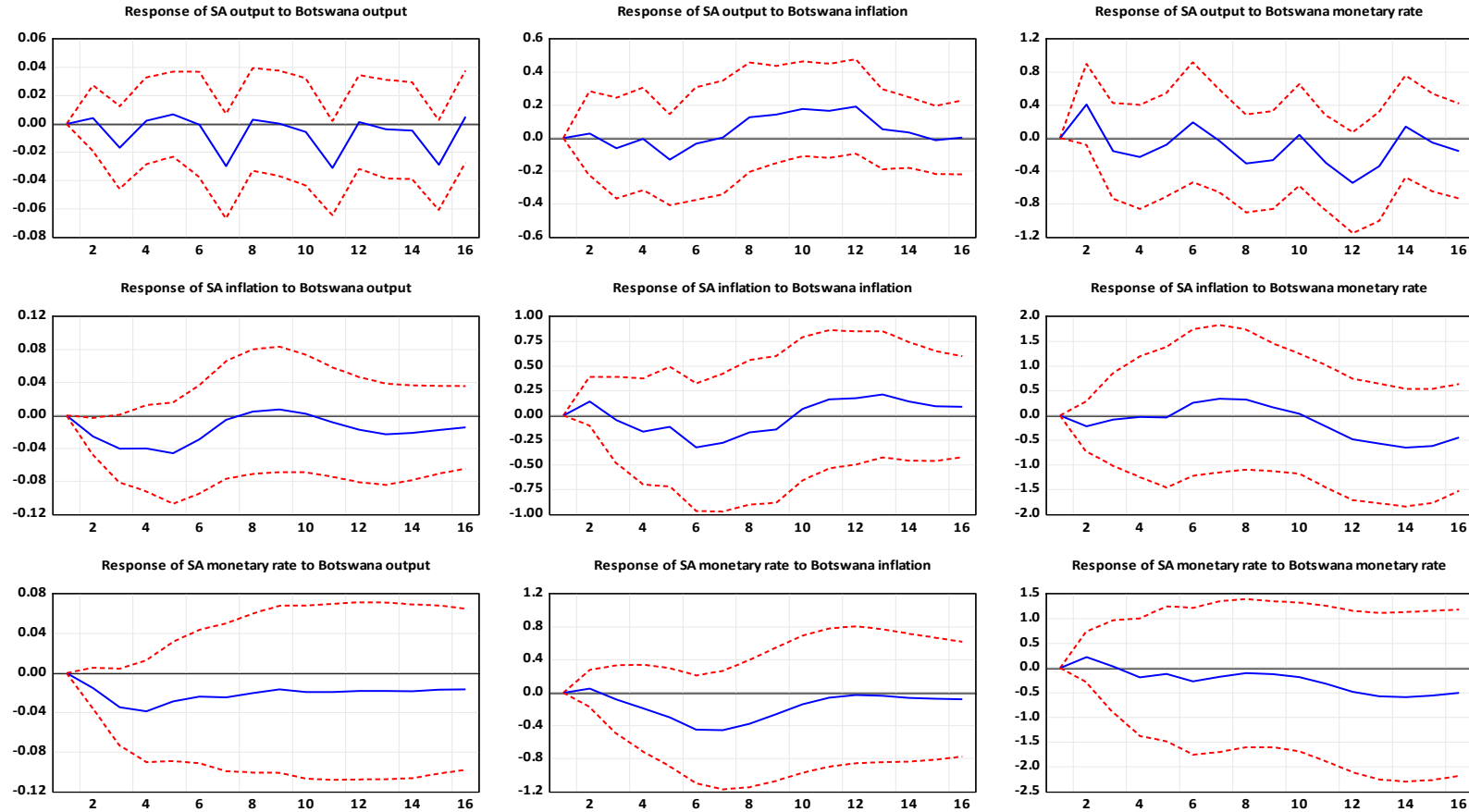
Causality test*	Null Hypothesis:	F-Statistic	p-value
Granger Causality	DLGDP_SA does not Granger Cause DLGDP	12.2835	0.0006
	DLGDP does not Granger Cause DLGDP_SA	1.23592	0.2685
	Null Hypothesis:	Zbar-Stat.	Prob.
Dumitrescu Hurlin Panel	DLGDP_SA does not homogeneously cause DLGDP	4.26250	2.E-05
	DLGDP does not homogeneously cause DLGDP_SA	-0.49462	0.6209

Note: \* - test performed at 1 lag.

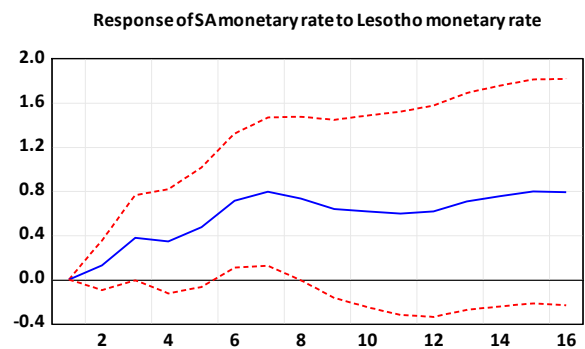
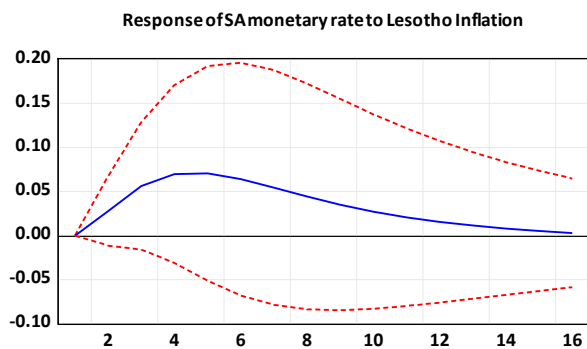
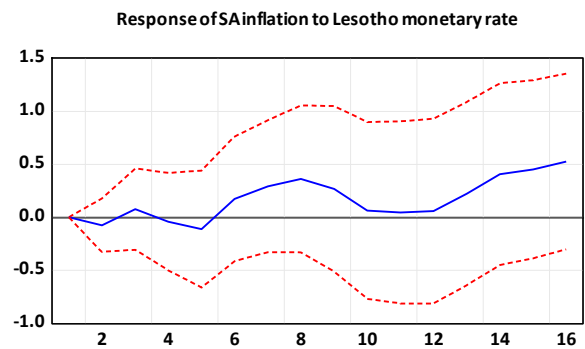
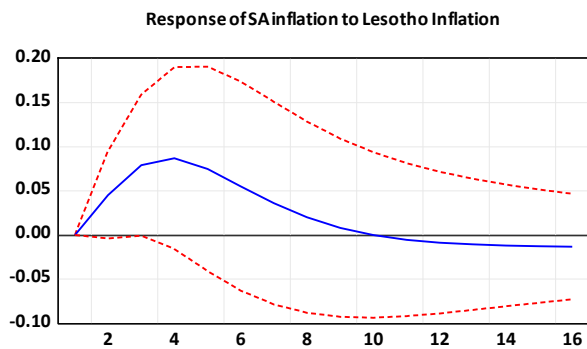
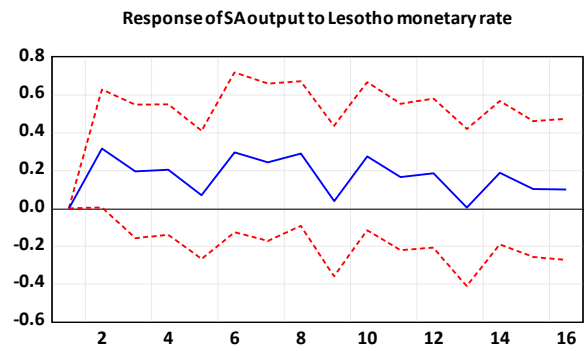
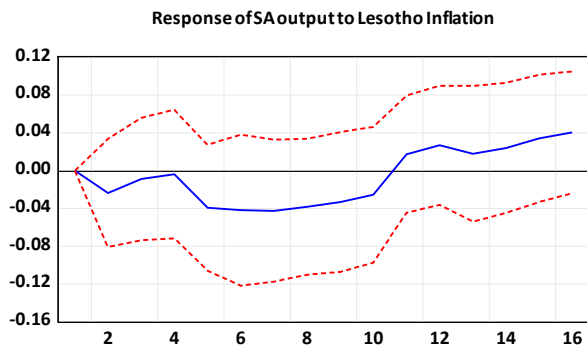


## Appendix C – Additional impulse response functions

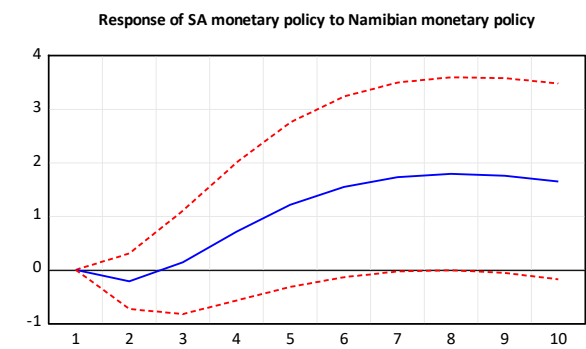
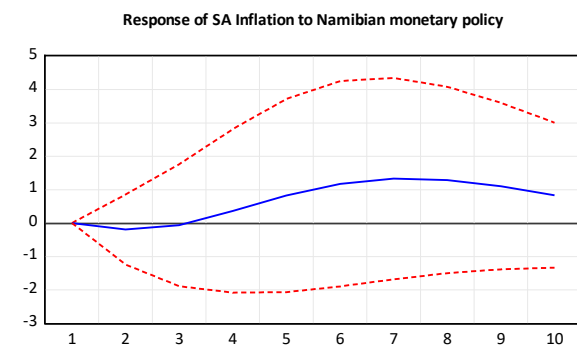
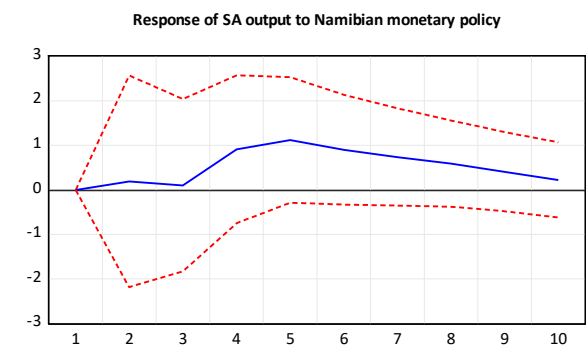
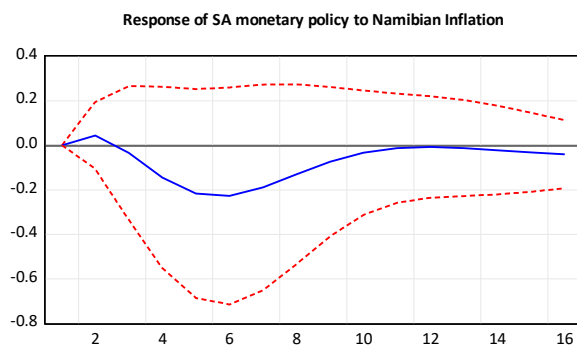
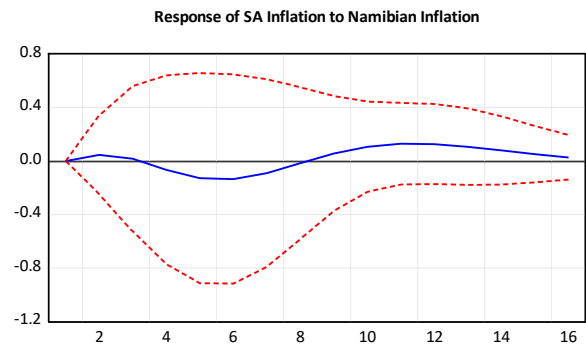
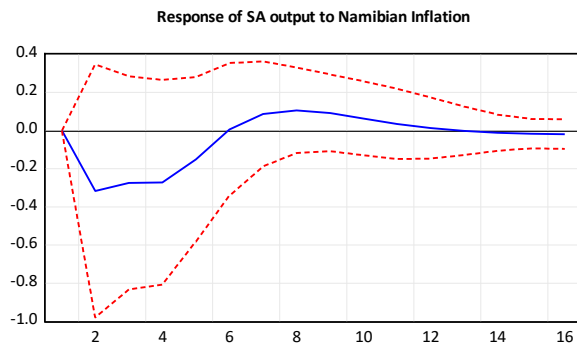
Impulse-response functions of South African variables to Botswana variables



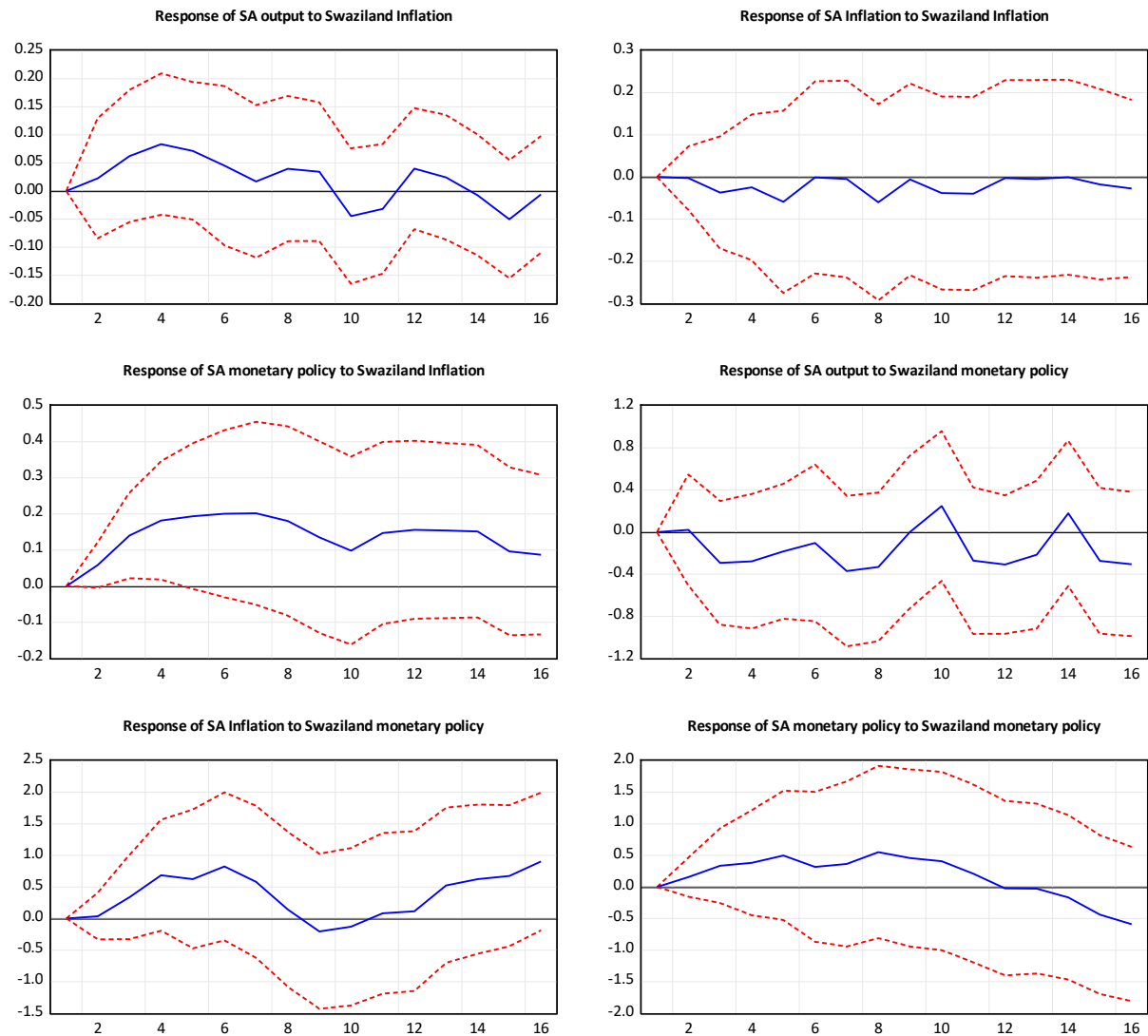
## Impulse-response functions of South African variables to Lesotho variables



## Impulse-response functions of South African variables to Namibian variables



## Impulse-response functions of South African variables to Swaziland variables



**ARTICLE III**  
**MONETARY AND FISCAL POLICY COORDINATION IN THE SACU AREA**

**1. INTRODUCTION**

**1.1. Monetary and fiscal policy interaction: general**

Monetary and fiscal policy interaction has been one of the central issues in the theory and practice of macroeconomic policy design. Interest in these policy interactions stems mainly from the following notions. Firstly, monetary- and fiscal policy both influence important macroeconomic variables (Nyamongo, Sichei and Mutai, 2008). Secondly, monetary- and fiscal policymakers use different policy instruments to achieve their respective policy objectives. Generally, the monetary- and fiscal policy instruments are the interest rate and the budget deficit, respectively. Fiscal policy may affect the efficiency of monetary policy through its impact on aggregate demand, while monetary policy may affect fiscal policy through its effects on the interest rates the government pays on its debt (Semmler and Zhang, 2004). Considering that monetary and fiscal policies are interdependent, fiscal (monetary) policymakers have to consider the effects of their policies on the economy and the decisions of monetary (fiscal) policymakers.

The points above highlight the interdependence of monetary and fiscal policy, the potentially significant consequences for the effectiveness of these policies in a country's economic performance (Reserve Bank of India, 2012), as well as the potential for policy coordination or non-coordination as these policies interact. These points also imply that, in practice, coordination may be difficult to achieve due to differences in the objectives of monetary and fiscal authorities, in the implications of policy actions for the economy and differences in the forecasts on the state of the economy used by the two authorities (Ramlogan and Sookram, 2018: 1). However, Saulo, Rego and Divino, (2013) assert that coordination can address the implications of diverse policy objectives, and the effects on the economy as well as the induced policy spillovers. In the case of strong policy coordination, there is a reduced potential for policy conflicts, a more exceptional ability to respond to asymmetric external shocks, a greater ability to establish stable inflation and economic growth path and, by extension, attain an overall improvement in economic welfare.

Therefore, this article aims to evaluate how the monetary and fiscal policies interact among the Southern African Customs Union (SACU) countries.

This analysis will ascertain whether the policies are coordinated or non-coordinated and the findings can provide policymakers with guidelines on decision-making and setting policies. The problem of how monetary and fiscal policies interact is relevant for the SACU countries, because member countries are responsible for their fiscal policies, while South Africa dominates by, effectively, setting monetary policy. In addition, the SACU region faces a high degree of economic interdependence, where policy actions in one member country can have an impact on other member countries via various direct and indirect spillovers. These spillovers imply that independent efforts by the monetary policy authority might result in multiple conflicting interests with the fiscal policy authority. Therefore, the monetary and fiscal policy setup among the SACU countries increases the need for macroeconomic policy coordination. This interaction of policies can either be in a coordinated or non-coordinated structure.

Monetary and fiscal policy interactions involve both the coordination of the policies within a single economy and the coordination of the policies between different countries, where monetary or fiscal policy actions of one country are partially transmitted to the other countries through various channels in goods, labour, money and financial markets (Van Aarle, Di Bartolomeo, Engwerda and Plasmans, 2002). Therefore, these policies are linked and policy spillovers exist across countries. Policy spill over and coordination is part of the focus of this article. However, the multi-country setup, particularly in a highly integrated region, also magnifies the difficulty of achieving monetary- and fiscal policy coordination. This difficulty arises from the possible different economic and political conditions in the countries, the various potential externalities that could arise from country linkages, and possible differences in the macroeconomic policy transmission mechanisms within the region (Van Aarle *et al.*, 2002).

## **1.2. Monetary and fiscal policy interaction: monetary union**

In a monetary union setup, how the common monetary policy and the different national fiscal policies interact is a crucial issue for member countries.

Therefore, two main policy interactions have to be considered: the interaction between the national fiscal policies of the countries (referred to as horizontal interaction), as well as the interaction between the common monetary policy and the decentralised national fiscal policies (referred to as vertical interaction). Horizontal interaction implies that the decentralised national fiscal policies can be coordinated or non-coordinated, while vertical interaction means coordination or non-coordination of monetary and fiscal policies.

In literature, a coordinated setup often refers to a situation where monetary and fiscal policymakers set their policies jointly by taking into account each other's objectives and policy decisions (Di Bartolomeo, Engwerda, Plasmans, Van Aarle and Michalak, 2005). However, this form of coordination is not accepted in South Africa, because section 224 of the Constitution of the Republic of South Africa of 1996 calls for the independence of the central bank with clear separation of monetary and fiscal powers. It states that "the Bank, in pursuit of its primary object, must perform its functions independently and without fear, favour or prejudice, but there must be regular consultation between the Bank and the Cabinet member responsible for national financial matters" (section 224 of Constitution, 1996). The regulation above then makes it unlikely for the South African Reserve Bank (SARB) to participate in any form of joint decision process with other national governments. However, the absence of joint decision making does not preclude harmonised interaction and coordination. One policy institution can still set its policy, taking into consideration the other policy institution's stance without making the decision jointly.

Therefore, against this backdrop, coordination of monetary and fiscal policies refers to the harmonised interaction between the policies. Conversely, a non-coordinated setup refers to policymakers setting their policies with no joint decisions, and by extension, no harmonised decisions or actions (Saulo *et al.*, 2013). The non-coordinated structure is generally accepted in the literature as the norm, where the objective function of a central bank is different from that of the government (Kappel and Janku, 2014). According to Basdevant, Benicio, Mircheva, Mongardini, Verdier, Yang and Zanna, (2011) and Nakale, Sikanda and Mabuku (2015), the SACU countries have their monetary policy objective as maintaining price stability while the fiscal policy objective is promoting macroeconomic stability, a prerequisite for sustainable economic growth.

Therefore, if these authors are right, in practice, the central bank and the government do not cooperate in setting their economic policy instruments at the time of their decision. The analysis below will explore this further.

Similar to Kappel and Janku (2014), for this analysis, coordination of monetary and fiscal policies refers to the synchronised interaction between the policies. Thus, in the case of coordination, both policies move in the same direction, i.e. fiscal and monetary policies both pursue either expansionary or contractionary policies. For example, in a contractionary policy scenario, a central bank would increase interest rates while the government reduces budget deficits to dampen aggregate demand and economic growth. However, non-coordination of the policies refers to a situation where the policies may move in opposite directions, i.e. when the monetary policy is expansionary (contractionary), the fiscal policy is contractionary (expansionary). Moreover, Jones (2009) refers to coordination as policymakers interacting as strategic complements and non-coordination as policymakers interacting as strategic substitutes.

Also, two main types of policy interaction are possible in the SACU region. The first one is that, given the sovereignty of these SACU countries, fiscal policy is unlikely to be centralised into a single fiscal authority and full fiscal policy coordination is a limited possibility in the region, because governments are not likely to decide jointly on how to formulate their fiscal policies. However, considering the interdependence of these economies, fiscal policy actions in one country are expected to spill over to the other member countries. Hence, the countries could in principle coordinate their fiscal policies. When exploring fiscal policy interaction, assessing the extent of fiscal policy spillovers in the region is essential for establishing the nature and appropriateness of policy coordination and policy design needed. Against the background of the dominance of the South African economy in the SACU region, the question is whether or not South African fiscal policy activity spills over to the fiscal policy actions of the BLNS countries. If there are significant fiscal policy spillovers, this would have implications for the formulation of fiscal policy reaction functions of the BLNS countries because the BLNS countries would take the South African fiscal policy into account in formulating their fiscal policies.



Coordination of fiscal policies enables internalisation of the policy spillovers (Plasmans, Engwerda, Van Aarle, Di Bartolomeo and Michalak, 2006).

In a monetary union, the influential trade linkages between member countries, and the common monetary policy and exchange rate point to the need to coordinate fiscal policies (Aviat, Diot, El Kasmi and Jegou, 2016). The issue of fiscal policy coordination is significant in a monetary union because high integration between member countries increases the cross-border effects of fiscal policy developments originating in each member country (D'Auria, Linden, Monteiro, Veld and Zeugner, 2014). Moreover, increased cross-border effects necessitate more coordination between member countries. Therefore, in this study, the fiscal policy spillovers are defined as the effects of domestic fiscal policies on the other member countries (Alloza, Burriel and Perez, 2018).

The second type of policy interaction is the coordination between the common monetary policy and the fiscal policies of the member countries. For the SACU region, this means the coordination between the dominant South African monetary policy and the fiscal policy of each of the BLNS countries. According to Semmler and Zhang (2004), monetary and fiscal policy coordination is more likely to improve macroeconomic performance of a monetary union, since the policies are interdependent. Similarly, Plasmans *et al.* (2006) affirm that monetary and fiscal policy coordination among member countries can contribute to achieving an appropriate economic policy mix and higher welfare for the region as a whole as well as for its member countries. However, in the absence of monetary and fiscal policy coordination, the policy responses to economic conditions could result in a replication of efforts by policymakers or in setting countering policy instruments. This could lead to negative policy spillovers so that the existence of spillovers could lead to inefficient outcomes (Reserve Bank of India, 2012; Plasmans *et al.*, 2006). Therefore, uncoordinated policies may result in the inefficient macroeconomic performance of the countries. Furthermore, given the challenges associated with the sovereign debt crisis in Europe, understanding the interaction dynamics of fiscal and monetary policy provides a framework for understanding the effectiveness of such policies as well as whether or not they can be coordinated (Cevik, Dibooglu and Kutan, 2014).

Considering the nature and degree of interdependence in the SACU region, the main objective of this study is to determine the extent of the coordination between fiscal and monetary policy, from a regional perspective. The secondary objectives are:

- i. To investigate the degree of spillover effects between South African fiscal policy and the fiscal policies of the BLNS countries.
- ii. To establish whether or not the BLNS country monetary policies react to their respective fiscal policies and the South African fiscal policy
- iii. To establish whether or not BLNS country fiscal policies respond to the South African monetary policy.

The game theory approach and New Keynesian models are two of the important frameworks used in the analysis of policy interactions. As indicated in the literature review, they will contribute to the development of the model applied in this analysis by deriving reaction functions of monetary and fiscal authorities to economic changes and the other policy instruments. The reaction functions will then be estimated to establish how the South African monetary and fiscal policies interact with the BLNS countries' monetary- and fiscal policies. The next section reviews the literature related to the interaction of monetary and fiscal policies among different economies.

## **2. LITERATURE REVIEW**

The literature discussed below focuses on fiscal policy coordination and spillovers as well as the interaction of monetary and fiscal policies.

### **2.1. Fiscal policy coordination and spillovers**

For this study, the definition of fiscal spillovers is the effects of domestic fiscal policies on the fiscal policy of other member countries (Alloza *et al.*, 2018). The nature and extent of fiscal policy spillovers highlight the need for fiscal policy coordination.

#### **2.1.1. Fiscal policy coordination**

Generally, fiscal policy coordination involves national fiscal policy authorities working together or taking into account the fiscal policy action of the other countries.

Due to potential cross-border effects of fiscal policy developments originating in each member country, the issue of fiscal policy coordination is significant in a highly integrated region (D'Auria *et al.*, 2014). According to Aviat *et al.* (2016), the goal of fiscal policy coordination among member countries in a monetary union includes:

- Ensuring the stability of the monetary union.
- Maintenance of fiscal discipline in all member countries.
- Preventing fiscal policy actions of one country harming the economic situation of the other member countries through spillover effects.
- Defining an ideal union-wide fiscal stance mainly for short-term stabilisation.

There are opposing views on the necessity and desirability for fiscal policy coordination. Some researchers support it<sup>23</sup>, while other researchers find fiscal policy coordination to be undesirable.<sup>24</sup> According to Brunila (2002), fiscal policy coordination can prevent political distortions such as deficit bias and free-riding behaviour, since these could affect the stability and the credibility of the monetary union operations. The coordination of fiscal policies can reduce and internalise fiscal policy spillover effects, which would improve the macroeconomic performance (Plasmans *et al.*, 2006, Ferre, 2008; Bohn, 2006; De Bonis and Posta, 2010; Alcidi, Maattane and Thirion, 2015; Thirion, 2017). Faini (2006) and Cabral and Diaz (2015) highlight that, without fiscal policy coordination, the spillover effects, externalities, and free-riding incentives might yield inefficient outcomes.

Moreover, fiscal policy coordination may enhance stabilisation gains and takes into account heterogeneous economic structures in policy adjustments (Schalck, 2006; Ngai, 2012). Several researchers<sup>25</sup> assess the coordination between fiscal policy authorities. According to their research, the interaction of national fiscal policies is desirable because it improves the stability of the cooperating economies.

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<sup>23</sup> These include Jacquet, Pisani-Ferry and Strauss-Kahn (2001), Von Hagen and Mundschenk (2003), Uhlig (2002), Gali and Monacelli (2008), Gros and Alcidi (2010), Arestis (2011), Schalck (2012), Schalck (2014), Sly and Weber (2013), Landmann (2018), and Hettig and Muller (2018).

<sup>24</sup> These include Tabellini (1990), Gros and Hobza (2001), De Grauwe and Polan (2001), Beetsma, Debrun and Klaasen (2001), Belke and Gros (2009), and Cabral and Diaz (2015).

<sup>25</sup> Von Hagen and Mundschenk (2003), Di Bartolomeo *et al.* (2005), Beetsma *et al.* (2001), Faini (2006), Colciago, Muscatelli, Ropele and Tirelli (2008), Ferre (2008), Michalak, Engwerda and Plasmans (2009), Chortareas and Mavrodimitrakis (2017), and Hettig and Muller (2018).

However, for some researchers, fiscal policy coordination does not necessarily enhance welfare, since it hinders the ability of decentralised fiscal policies to respond to country-specific and asymmetric shocks, and structural problems. It also reduces the accountability of individual policymakers (Brunila, 2002).

Fiscal policy coordination implies that discretionary fiscal actions may be costly, time-consuming and may weaken national responsiveness to shocks (Schalck, 2012). Therefore, from this perspective, fiscal policy coordination does not necessarily enhance welfare in a monetary union. According to Beetsma *et al.* (2001) and Kirsanova, Machado and Ribeiro (2018), fiscal policy coordination increases the strategic weight of the fiscal authorities relative to the central bank, which may aggravate conflict with the central bank and could be counterproductive in stabilising the member countries and the monetary union as a whole. Hence, overlooking the fiscal policy effects could lead to inefficient policy outcomes (Brunila, 2002).

### **2.1.2. Fiscal policy spillovers**

The fiscal policies in one country can have spillover effects on other countries via three main channels: the demand channel, the competitiveness channel, and the financial markets channel (Alcidi *et al.*, 2015). The demand channel is commonly referred to as the trade channel and is related to budgetary policies. This channel exists when fiscal policy actions in one country affect the aggregate demand of another country. The competitiveness channel is also known as the terms-of-trade channel, which exists if a fiscal stimulus affects inflation and the terms-of-trade in one country, which then leads to a change in the competitiveness of another country. Lastly, the financial market channel exists if a government's borrowing actions in one country increase the risk-premium of government debt in other member countries of a monetary union, implying that sovereign debt risk spills over from one country to another (Alcidi *et al.*, 2015). An example is the sovereign debt crisis, which affected the Euro area countries and some EU countries had to bail out other economies that were hard hit by the crisis (such as Greece).

The sign of fiscal policy spillover effects found in the literature is either negative or positive depending on the relative magnitude of the direct trade effect and the impact of fiscal policy on the common interest and exchange rate (Brunila, 2002).

Existing empirical research on fiscal policy spillovers seeks to quantify the spillovers and is presented in the discussion below. Some researchers find evidence of positive spillover effects (e.g., Auerbach and Gorodnichenko, 2013; Carmignani, 2015). The positive spillovers exist when the fiscal policy in one country has a positive impact on the other country's economy, for example, when a fiscal expansion in one country improves the economic growth of the other country.

These studies show that the fiscal policy actions in one country may affect output and prices in another country through various channels such as imports, relative prices, the interest rates channel and other financial linkages (Alcidi *et al.*, 2015). The linkages are particularly strong and relevant in the context of a highly integrated monetary union. The most common channel tested empirically is the demand channel (e.g., Hebous and Zimmerman, 2013; Goujard, 2013; Carmignani, 2015; Alloza *et al.*, 2018). The demand channel is where a fiscal expansion in one country leads to an increase in demand in other member countries, through increased export demand in other member countries. The increased export demand enhances economic activity.

### **2.1.3. Empirical literature**

The relevance of fiscal policy coordination has often been examined by investigating whether or not fiscal policy should be centralised to a regional level or remain at the country level (Alcidi *et al.*, 2015). Examples of these studies include Cabral and Diaz (2015), Schalck (2012), and Alcidi, *et al.* (2015). The regionalisation and centralisation of fiscal policy refer to the institutional features and setup of fiscal policy. Therefore, at a regional level, the effectiveness of fiscal policy coordination depends on the level at which this coordination mechanism is formulated. Cabral and Diaz (2015) who assess the desirability of fiscal policy coordination in a monetary union, also conclude that an efficient economic outcome is achieved if fiscal policy is coordinated at a regional level.

Fiscal policy coordination is a prominent topic of discussion for the European Monetary Union (EMU). The framework for fiscal policy coordination in the European Union includes the following mechanisms: the Excessive Deficit Procedure (Article 104); the Stability and Growth Pact (SGP) (regulation 1467/97); the Mutual Surveillance Procedure (Article 99-3) and the Broad Economic Policy Guidelines (Article 99).

The Maastricht Treaty provides an institutional framework that includes restrictions on deficit and debt (Beetsma and Debrun, 2004), and the SGP offers clarity on the Excessive Deficit Procedure. However, the EMU fiscal criteria have mainly been criticised on the basis that it limits the flexibility of using fiscal policy for stabilisation of country-specific shocks (Schalck, 2012). According to Alcidi *et al.* (2015), policy coordination can have inefficient outcomes in a monetary union, when it is restricted to just the fiscal authorities without involving the common central bank.

Given the strong interaction between fiscal and monetary policies, cooperation among fiscal authorities can affect the dynamics of this interaction and affect the macroeconomic stability of the union. For example, fiscal policy coordination can increase the strategic power of fiscal authorities relative to the central bank, threaten central bank independence by pressurising the central bank to monetise public debt and thereby, jeopardise the credibility of its commitment to price stability (Issing, 2002). Furthermore, Dragomirescu-Gaina and Philippas (2015) focus on fiscal policy coordination among European Union member states and assert that available policy options to deal with idiosyncratic shocks become limited when there is fiscal policy coordination. The authors also suggest that in a case where monetary and fiscal policymakers have different views on how to stabilise prices, fiscal policy coordination might decrease welfare (Dixit and Lambertini, 2003; Beetsma *et al.*, 2001).

In the wake of the financial and sovereign debt crises affecting the European Monetary Union (EMU), fiscal policy coordination has become even more relevant in the EMU because the existing fiscal coordination mechanisms failed to prevent and contain the crises. On this front, Foresti (2013) highlights that the existence of effective fiscal coordination mechanisms promotes coordination between the national fiscal authorities and the regional central bank. This finding implies that for effective fiscal policy coordination in a monetary union, it is necessary to have fiscal discipline and binding fiscal mechanisms. In addition, the existence of spillover effects from national fiscal policies in a monetary union provides grounds for fiscal policy coordination (Alcidi *et al.*, 2015; Beetsma and Debrun, 2004; Beetsma *et al.*, 2001; Alesina and Wacziarg, 1999). With decentralised fiscal policies that generate spillover effects, there is also a need for some policy coordination or centralisation in the integrated region.

Therefore, the rationale for fiscal policy coordination is based on economically critical fiscal spillovers that contribute to inefficient welfare outcomes (Alcidi *et al.*, 2015). However, as much as the existence of significant spillovers is necessary to make a case for closer fiscal coordination, they are not sufficient to establish that such coordination would be welfare improving.

Furthermore, in a monetary union, the nature and effectiveness of fiscal policy coordination depend on the type of shocks hitting the economy and the magnitude of spillovers resulting from national fiscal policies (Aviat *et al.*, 2016, Beetsma *et al.*, 2001). Symmetric or asymmetric shocks hit economies in a monetary union. Fiscal policy coordination between member countries is appropriate in a monetary union with country-specific shocks because in such a situation fiscal policy is the only suitable tool available (Di Bartolomeo *et al.*, 2005; Ferre, 2008; Alcidi *et al.*, 2015; Bhattarai and Mallick, 2016; Foresti, 2018). Hence, from the perspective of the regional central bank, it would make sense that countries use their fiscal stance to counter the country-specific shocks. However, the case for fiscal coordination is weak in the case of a common shock within the region, because the regional monetary policy would be utilised to counter the common shock (Di Bartolomeo *et al.*, 2005; Michalak *et al.*, 2009; Beetsma *et al.*, 2001; Alcidi *et al.*, 2016).

The majority of EMU research on fiscal policy spillover effects and their link to fiscal policy coordination involve estimating fiscal spillover effects to assess the usefulness and need for fiscal policy coordination. Examples include Alloza *et al.* (2018), Gambetti and Galio (2016), and Hebous and Zimmerman (2013). According to Aviat *et al.* (2016), from the early stage of the EMU's existence, fiscal policy coordination was considered necessary for the proper functioning of a monetary union. The main findings from the EMU studies are significant fiscal spillovers among member countries and significant differences in the magnitude of spillovers across countries (Caporale and Girardi, 2013; Belke and Osowski, 2019; Alloza *et al.*, 2018). These spillover effects operate through the demand channel because of trade linkages. Gambetti and Galio (2016) also find that the magnitude of spillovers is significantly higher in periods of financial crisis. The main implications of the EMU findings are that these economies are highly integrated, and fiscal policy coordination could be considered as a way of improving macroeconomic stability for the member countries.

The most common method used for the analysis of fiscal policy spillover effects is the VAR. Examples of studies include Hollmayr (2011), Hebous and Zimmerman (2013) and Belke and Osowski (2019), who use a Global VAR (GVAR) model; Gambetti and Gallio (2016) who use a time-varying coefficient VAR model; Dabla-Norris, Dallari and Poghosyan (2017) who used a panel VAR model and Alloza *et al.* (2018) who used a structural VAR (SVAR) model. With a VAR method, the fiscal policy spillover effects are identified using impulse response functions and variance decompositions.

The discussion above indicates that the literature is still inconclusive on the desirability of fiscal policy coordination, which means coordination can have positive, negative or neutral effects on welfare, depending on economic structure, the shocks that hit the economies, the nature of the spillover effects and the policy objectives of the fiscal and monetary authorities. Alcidi *et al.* (2015: 6) concur, "...while the existence of fiscal spillovers in principle calls for the coordination of national fiscal policies, uncertainty about the functioning of such effects as well as political economy considerations make the design of effective policy coordination a challenging task". Furthermore, regarding fiscal policy spillover effects, in reality, shocks occur and uncertainty exists, which makes it challenging to ascertain the nature, the channel and the degree of particular fiscal policy spillovers. Therefore, such uncertainty makes it difficult to argue for fiscal policy coordination even if in theory the existence of spillover effects calls for it (Alcidi *et al.*, 2015).

#### **2.1.4. Fiscal sustainability**

On a different note, because fiscal sustainability implies monetary policy effectiveness and setup, it is necessary to ensure the sustainability of fiscal policy, particularly in a monetary union setup. Fiscal sustainability is essential in a financial union setup because an unsustainable fiscal policy could create negative externalities for other member countries and compromise the operations, credibility and effectiveness of the common monetary policy (Haltom and Weinberg, 2015). Fiscal sustainability refers to "... the ability of a government to assume the financial burden of its debt in the future" (Berrittella and Zhang, 2015: 261). The issue of fiscal sustainability gained more interest after the outbreak of the global financial crisis from 2007 to 2009 and the subsequent debt crisis of 2012 in Europe.



The government's fiscal policy stance is sustainable if it can maintain a stable long-term primary balance (Jibao, Schoeman and Naraidoo, 2012; Baharumshah, Soon and Lau, 2017). In essence, fiscal sustainability involves assessing the adjustment of fiscal actions 'to economic developments, particularly previous fiscal developments.

Estimation of fiscal reaction functions is one of the common approaches used to assess fiscal sustainability. The approach was pioneered by Bohn (1998), who highlights that fiscal policy is sustainable when the primary balance responds positively to an increase in public debt (Afonso and Jalles, 2011; Lyziak and Mackiewicz-Lyziak, 2019). Therefore, an estimation of the fiscal reaction function tests the hypothesis that "... the government adjusts the primary budget balance in response to changes in indebtedness so as to ensure the sustainability of the debt dynamics over time" (De Mello, 2005: 9).

In literature, fiscal reaction functions are used to:

- Establish whether there is fiscal sustainability (Claeys, 2008; Burger, Stuart, Jooste and Cuevas, 2011; Tashevskaja, Trpkova-Nestorovska and Trenovski, 2018; Shijaku 2012; Chandia and Javid, 2013; Mercan, 2014; Berrittella and Zhang, 2015; Mutuku, 2015; Aldama and Creel, 2019; Baharumshah *et al.*, 2017; Vdovychenko, 2017; Beqiraj, Fedelu and Forte, 2018; Bokemeier and Stoian, 2018; Tran, 2018);
- Examine fiscal behaviour or performance over time (Bohn, 1998; De Mello, 2005; Favero and Giavazzi, 2007; Baldi and Staehr, 2013; Weichenrieder and Zimmer, 2014; Luporini, 2015; Benetrix and Lane, 2013; Chandia and Javid, 2013; Plodt and Reicher, 2015; Jansen, 2016; Checheritta-Westphal and Zdarek, 2017; Combes, Minea and Sow, 2017; Beqiraj *et al.*, 2018; Barbier-Gauchard and Mazuy, 2018);
- Establish the effectiveness of fiscal policy as a stabilisation tool (Ardagna, Caselli and Lane, 2007; Bull and Dowd, 2005; Chandia and Javid, 2013; Bergman, Hutchison and Jensen, 2016; Mutuku, 2015; Lyziak and Mackiewicz-Lyziak, 2019).

In all the above-mentioned uses of the fiscal reaction function, the main attribute is the discipline of the fiscal authorities in response to public debt as well as how the economy responds to fiscal developments over time.

The main implication of finding an unsustainable fiscal policy or debt is that economies face severe financing difficulties undermining their solvency, compromising the functioning of a common central bank in a monetary union. Moreover, findings of an unsustainable fiscal stance could indicate the need for forms of fiscal policy monitoring to avoid a situation of fiscal fatigue where there are very high debt levels and fiscal effort becomes untenable (Checherita-Westphal and Zdarek, 2017). Such an analysis is relevant for the SACU countries because currently, there are no forms of monitoring of public finance at a regional level to guide fiscal policy conduct.

## **2.2. Monetary and fiscal policy interaction**

The research on the interaction between monetary and fiscal policy includes issues related to optimal monetary and fiscal policy mix, the coordination of monetary and fiscal policies as well as the channels through which these policies affect one another (Javid, Arif and Sattar, 2008). This current study focuses on the last two issues. Studies on the coordination of monetary and fiscal policies have used theoretical and empirical frameworks to assess the strategic interaction of monetary and fiscal policy within a country as well as in monetary unions. A common message from all these different frameworks is that a certain degree of monetary and fiscal policy coordination is always desirable, regardless of the policy regime in place, and ensures that the policymakers honour their policy commitments (Arce, 2005).

In a monetary union with no policy coordination, monetary and fiscal authorities compete in the determination of aggregate demand, which could lead to an inefficient combination of large public deficits and high interest rates. Therefore, the benefits of macroeconomic coordination for countries include reduced external vulnerability, the ability for improved response to common shocks and reduced transmission of macroeconomic instability (Valdivia and Perez, 2013).

The main areas of focus regarding the interaction of monetary and fiscal policy include the extent of coordination between policies ranging from non-cooperation to cooperation and the position of policy authority in the policymaking process, i.e. simultaneous, leader or follower. These areas have implications for the specification of the objective functions of the policymakers as well as their reaction functions. Furthermore, economies have a choice of setting their monetary and fiscal policies individually, collectively or anything in between. This option means that policymakers can choose to coordinate, partially coordinate or not coordinate their monetary and fiscal policies.

The modern mainstream literature on the interaction between monetary and fiscal policy includes the seminal work of Sargent and Wallace (1981), who assert that an unsustainable fiscal policy environment poses challenges for the implementation of monetary policy. Sargent and Wallace (1981) identify two strategic policy interaction regimes of monetary dominance and fiscal dominance, where under monetary dominance, in a bid to stabilise price levels, the monetary policy authority sets its policy independently and then guides fiscal policy to achieve related targets. Thus, when the monetary authority is dominant, it can commit to a specific monetary policy so that, at some point, the fiscal authority will adjust its policy instrument to ensure the solvency of the government (Ballabriga, 2004).

Under fiscal dominance, the monetary policy authority is expected to generate the seigniorage revenues needed to guarantee government solvency (Lin and Chu, 2013). Therefore, the main implications of the Sargent and Wallace argument are that, regardless of the policy regime at work, a certain degree of coordination between monetary and fiscal policies is always needed (Arce, 2005). Moreover, under a fiscal dominance regime, fiscal policy conduct can make it impossible for monetary policy to maintain price stability, as long as the central bank accommodates its policy to satisfy some fiscal requirements (Beetsma and Debrun, 2004).

### **2.2.1. Fiscal theory of the price level**

Another line of research in the analysis of the interaction between monetary and fiscal policies concerns the fiscal theory of the price level (FTPL) pioneered by Leeper (1991), Sims (1994), and Woodford (1995, 1998).

In contrast to Sargent and Wallace (1981), in the FTPL, the price level changes to make the real value of the outstanding debt consistent with the fulfilment of the government budget constraint (Beetsma and Debrun, 2004). In developing the FTPL, Leeper (1991) distinguishes between active and passive economic policy, highlighting that for economic stability to be achieved, monetary and fiscal policies should be either active or passive (Leith and Wren-Lewis, 2000). According to the FTPL, fiscal policy plays an essential role in the determination of the price level through an interaction between inflation, interest rates, government debt, and fiscal deficits via the dynamic government budget constraints (Plasmans *et al.*, 2006; Bassetto, 2008).

The FTPL suggests that the government sustains its fiscal policy through increases in prices that erode the real value of public debt and financial wealth (Javid *et al.*, 2008). Fiscal solvency determines the equilibrium price, which means that monetary and fiscal policy may interact through their joint influence on government debt dynamics. Moreover, fiscal indiscipline and debt unsustainability in one country may eventually spill over to other, more prudent countries in the form of higher interest rates or enforced bailouts in the form of seignorage by the country's central bank (Plasmans *et al.* 2006). Therefore, in the FTPL framework, the interactions between monetary and fiscal policies relate to the consequences of the budget deficit financing for monetary management and vice versa (Daly and Smida, 2014).

According to Daly and Smida (2014: 2), on the one hand, the monetary policy stance will affect the cost of servicing debt through changes in interest rates and the government's capacity to finance the budget deficit through its ability to monetise the debt. On the other hand, the fiscal policy stance will constrain the operational independence of the monetary authority through the government's budget deficit position. Therefore, FTPL provides a framework for determining how the monetary and fiscal policies interact, and which one is dominant. This is important because, despite the independence of a central bank and its commitment to low inflation, specific measures need to be taken to ensure an appropriate fiscal policy so as to achieve the objective of price stability (Javid, *et al.*, 2008; Fialho and Portugal, 2005; Loyo, 1999). As a result, monetary and fiscal policy coordination is necessary for price determination and stability.

Furthermore, when exploring the FTPL in the context of a monetary union, Bergin (2000) points out that international spillovers from fiscal policy can arise because the price level is determined jointly by the budget constraints of union participants.

“In particular, if a country decides to increase its public debt without backing the increase by a rise in future taxes, then the price level rises throughout the entire union” (Beetsma and Debrun, 2004: 104). The discussion above indicates that how monetary and fiscal policies interact is an important issue for the proper economic functioning of a monetary union and, mainly, the mismanagement of the decentralised fiscal policies do hold an implication for the common monetary policy goal of stabilising price levels. Therefore, national fiscal policies need to be coordinated with the common monetary policy. Also, in a monetary union with a common monetary policy and decentralised fiscal policy, non-coordinated policies may seriously impede economic stabilisation and result in inferior overall economic performance, because a weak policy stance in one policy area burdens the other area and is untenable over time (Vieira, Machado and Ribeiro, 2018; Daly and Smida, 2014).

Extensive research has been undertaken to discuss monetary and fiscal policy interactions in the FTPL framework.<sup>26</sup> The FTPL has been empirically tested by explaining the relationship between fiscal deficits and inflation (e.g., Nguyen, 2015; Lin and Chu, 2013; Jayaraman and Chen, 2013; Nawaz *et al.*, 2012; Ezeabasili *et al.*, 2012). In examining the validity of the FTPL, these researchers test whether or not fiscal deficits have a significant effect on inflation. The FTPL is valid if fiscal deficits have a significantly positive impact on inflation. The empirical research into the relationship between fiscal deficits and inflation provides mixed evidence of the validity of the FTPL.

Some researchers find support for the FTPL (Jayaraman and Chen, 2013; Fan and Minford, 2009; Serfraz and Anwar, 2009; Loyo, 1999; Davig and Leeper, 2005) and some do not (Canzoneri *et al.*, 2001; Nawaz *et al.*, 2012; Ezeabasili *et al.*, 2012; Daly and Smida, 2014), for different countries and time periods.

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<sup>26</sup> e.g., Loyo, 1999; Tanner and Ramos, 2003; Sala, 2004; Semmler and Zhang, 2004; Linnemann and Schabert, 2002; Canzoneri, Cumby and Diba, 2001; Canzoneri, Cumby and Diba, 1999; Kim, 2003; Javid *et al.*, 2008; Lin and Chu, 2013; Jayaraman and Chen, 2013; Nawaz, Iqbal, Ali and Zaman, 2012; Ezeabasili, Mojekwu and Herbert, 2012; Nguyen, 2015; Daly and Smida, 2014

The implication of finding support for the validity of the FTPL is that seigniorage is the primary method of financing government deficits and that fiscal discipline and an appropriate fiscal policy are key since a less credible fiscal policy could have substantial effects of economic stability (Thams, 2007).

However, as much as the FTPL is one of the frameworks for assessing the interaction between monetary and fiscal policies, it does not apply to the SACU region because the Constitution of South Africa does not support the issue of fiscal dominance and debt monetisation. Section 224 of the Constitution of the Republic of South Africa of 1996 states that

"the Bank, in pursuit of its primary object, must perform its functions independently and without fear, favour or prejudice, but there must be regular consultation between the Bank and the Cabinet member responsible for national financial matters."

Moreover, the *South African Reserve Bank Act* of 1989, sections 13(f) states that

"the Bank may not hold in stocks of the Government of the Republic which have been acquired directly from the Treasury by subscription to new issues, the conversion of existing issues or otherwise, a sum exceeding its paid-up capital and reserve fund plus one-third of its liabilities to the public in the Republic."

### **2.2.2. Game theory**

The game theory approach is another common theoretical framework used for analysing the interaction of monetary and fiscal policy. Some researchers explore the coordination of monetary and fiscal policies from this strategic perspective.<sup>27</sup> These studies involve analysing the behaviour of monetary- and fiscal authorities and available options to these authorities in setting their respective policies. This approach is the framework mostly used in literature to analyse strategic policy coordination. Hence it will contribute to the development of the model applied in this article.

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<sup>27</sup> E.g. Van Aarle, *et al.*, 2002; Lambertini and Rovelli, 2003; Dixit and Lambertini, 2003; Di Bartolomeo and Digioacchino, 2005; Canzoneri, Cumby and Diba, 2011; Michalak *et al.*, 2009; Buti, Roeger and Veld, 2001; Flotho, 2012a; Merzlyakov, 2012; Hallet, Libich and Stehlik, 2014; Libich, Savage and Walsh, 2011; Blueschke and Neck, 2015

The focus of the game theory approach is to derive reaction functions of monetary and fiscal authorities to economic changes and the other policy instruments. In such a framework, analysis of the policy interaction entails monetary and fiscal policy authorities deriving their respective policy reaction functions by minimising their loss functions that incorporate their policy target variables, inflation and output gaps. The form of the policy reaction functions depends on the different institutional arrangements such as the information available to each policymaker when setting their policy instruments, the various assumptions about the timing of the play, whether or not the policymakers can either act simultaneously or sequentially and the possibility of coordination between policymakers.

As mentioned above, the interaction between monetary and fiscal policy can be a coordinated or non-coordinated setup. A coordinated arrangement in game theory often refers to a situation where monetary and fiscal policymakers derive their reaction functions by minimising a joint loss function (Buti, Larch and Balboni, 2009; Flotho, 2012a). Kappel and Janku (2014), Abdel-Haleim (2016), and Ramlogan and Sookram (2018) refer to coordination as a situation where the objectives and actions of fiscal and monetary policymakers are non-contradictory. A non-coordinated setup in game theory often refers to a situation where monetary and fiscal policymakers derive their reaction functions by minimising their respective loss functions. Kappel and Janku (2014) analyse the interaction of monetary and fiscal policy in a non-coordinated setup, and they assert that monetary and fiscal policy authorities can be in conflict where they have contradictory objectives and actions. Such a scenario has been deemed unfavourable and detrimental to the welfare of a society (Michalak *et al.*, 2009). Moreover, in a non-coordinated setup, the position of a policymaker in the policymaking process, i.e. whether or not the policymakers act simultaneously or sequentially, is an essential aspect of the analysis of the interaction between monetary and fiscal policy.

The most common non-coordinated policy arrangements considered in the literature for monetary and fiscal policy interaction are the Nash and Stackelberg equilibriums.<sup>28</sup>

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<sup>28</sup> Blueschke and Neck, 2015; Saulo *et al.*, 2013; Beetsma and Jensen, 2005; Forlatti, 2009; Van Aarle *et al.*, 2002; Di Bartolomeo and Giuli, 2011; Hallet, Libich and Stehlik, 2014

The Nash arrangement is a form of non-coordination where monetary and fiscal authorities act simultaneously and independently, without knowing the reaction of the other (Saulo *et al.*, 2013). The policymakers derive their reaction functions by minimising their loss functions while assuming that their behaviour will not affect that of the other policymaker, i.e. they disregard spillovers and then obtain reaction functions for monetary policy and fiscal policy each. The main disadvantage of the simultaneous decision-making is that the monetary and fiscal policymakers can have divergent perceptions about the economic situation, which would give rise to policy adjustments as policymakers seek to offset each other's policy choices (Buti *et al.*, 2009).

The Stackelberg arrangement is a form of non-coordination where policymakers act sequentially with one of the policymakers as the Stackelberg leader and another, the Stackelberg follower (Di Bartolomeo and Digioacchino, 2005; Kappel and Janku, 2014). In this case, the Stackelberg leader makes the first move by choosing its policy stance knowing the follower's reaction and the follower has the chance to set its policy instruments by adapting to the leader's policy (Buti *et al.*, 2009). According to Libich *et al.* (2011), being the Stackelberg leader is an advantage in this game, as it allows a player to force the follower to cooperate. Regarding the specific allocation of roles in the Stackelberg interaction, either of the policymakers can be leaders in this policy setting.

Dixit and Lambertini (2003), Chari and Kehoe (2007) and Vieira *et al.* (2018) argue for the central bank to be the Stackelberg leader and the fiscal authority as the follower. If the central bank is the leader, then it is able to commit to the objective of price stability and is in a position to predict the fiscal policymaker's response for a given choice of the interest rate. Conversely, other researchers argue for the fiscal authorities to be the Stackelberg leader. In that sense, fiscal policy is set taking into account the anticipated reaction function of the monetary authority.<sup>29</sup> Fiscal leadership is the most preferred in literature because fiscal policy decisions take a long time and fiscal policy is difficult to adjust vis-à-vis monetary policy (Beetsma and Debrun, 2004; Buti *et al.*, 2009; Dai and Sidiropoulos, 2011).

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<sup>29</sup> Beetsma and Bovenberg, 2000, Buti *et al.*, 2009, Saulo *et al.*, 2013; Chen, Leeper and Leith, 2015; Dai, Sidiropoulos and Spyromitros, 2015; Chortareas and Mavrodimitrakis, 2017



Compared to the Nash arrangement, the Stackelberg setup eliminates the policy conflict of simultaneous decision making because the leader cannot revise its initial policy stance once the follower reveals its policy reaction function.

The game theory framework and the FTPL are some of the theories used in the theoretical and empirical analysis of the coordination between monetary and fiscal policies in a monetary union setup. The most common example of a monetary union in literature is the European Monetary Union (EMU). According to Merzlyakov (2012), the creation of the EMU prompted detailed research on the interaction of fiscal and monetary authorities and, hence, suggested solutions for practical problems. One of the findings from the research on the interactions of monetary and fiscal policies for the EMU is that the EMU member countries face inefficiencies from a lack of coordination between the monetary and fiscal authorities and imperfect coordination among national fiscal policies.<sup>30</sup>

Moreover, the main conclusion from these studies is that the coordination between the common monetary policy and individual country fiscal policies has welfare-improving outcomes for the union member countries. The EMU has a common monetary policy centralised and formulated by the European Central Bank (ECB), while the fiscal policy remains the responsibility of member countries. According to Michalak *et al.* (2009), the general view is that fiscal policy bears the main burden of stabilisation since the common monetary policy cannot address country-specific shocks. Therefore, coordination between the common monetary policy and the decentralised fiscal policies is essential to avoid counterproductive outcomes and inferior levels of welfare brought about by lack of coordination. However, van Aarle *et al.* (2002) highlight that policy coordination is beneficial only when both policy authorities are pursuing an admirable goal. If one of the authorities is not acting in the best interests of the member countries, then policy coordination is not an ideal option. Therefore, in this thesis the scenario considered is when both policy authorities are acting in the best interest of the member countries.

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<sup>30</sup> Wyplosz (1999), Van Aarle, Di Bartolomeo, Engwerda and Plasmans (2002), Von Hagen and Mundschenk (2003), Gali and Monacelli (2008), Beetsma and Bovenberg (2000), Carlberg (2006), Kirsanova, Stehn and Vines (2005), Michalak *et al.* (2009), Buti *et al.* (2009), Menguy (2011), Flotho (2012b), Libich and Stehlik (2012), Blueschke and Neck (2015), Chortareas and Mavrodimitrakis (2017), Foresti (2018), and Vieira *et al.* (2018)

According to Wyplosz (1999), monetary and fiscal policy in the EMU can be used as strategic substitutes, which means that as the central bank tolerates more inflation, the government has less incentive to expand through running a deficit.

Conversely, as the government engages in more expansionary policy, the central bank has less incentive to increase inflation. Because fiscal discipline is important for a credible monetary policy, the European Union formulated the Maastricht Treaty, which includes restrictions on deficit and debt (Beetsma and Debrun, 2004). This Treaty acts as a form of mechanism to promote coordination of monetary and fiscal policies among EMU member countries. However, according to Von Hagen and Mundschenk (2003), Menguy (2011), and Schalck (2012), these EMU coordination processes and mechanisms are inadequate for dealing cooperatively with the relevant policy divergences at the EMU level.

Furthermore, because public debt considerably increased in many European and EMU countries between 2008 and 2012, the nature and implications of monetary and fiscal policy coordination in the EMU have evolved during the global financial crisis and the sovereign debt crisis (Vieira *et al.*, 2018). Because the level of government indebtedness may crucially affect the economic sustainability of the member countries and the optimal functioning of the monetary union, the crises periods raised questions concerning the degree of policy coordination within the EMU and the commitment of policymakers to their assigned objectives (Foresti, 2018). With high debt levels, policy coordination has more precise and welfare-improving stabilisation goals than low debt levels. This implies that the coordination of monetary and fiscal policies is more compelling with high levels of government indebtedness (Vieira *et al.*, 2018).

### **2.2.3. Set-theoretic approach**

Apart from the FTPL and game-theoretic approach, the set-theoretic approach (STA) is another theoretical framework used to model explicit coordination. The STA methodology by Arby and Hanif (2010) aims to quantify the level of coordination between monetary and fiscal policy given different economic shocks. The main reasoning of the STA is that "...the potential for healthy policy coordination exists when two policy-making authorities are independent and can pursue their objective without compromising one for the other" (Ramlogan and Sookram, 2018: 9).

The STA looks at how monetary and fiscal policy authorities respond to shocks to policy target variables, which are economic growth and inflation rate. According to Abdel-Haleim (2016), the extent of monetary and fiscal policy coordination depends on an appropriate policy mix that responds effectively to economic growth and inflation shocks. In other words, there is coordination when there are prudent policy reactions to inflation and economic growth disturbances (Tarawalie, Sissoho, Conte and Ahorator, 2013).

A few researchers applied the set-theoretic approach (STA) to establish the extent of coordination between monetary and fiscal policy. These include Arby and Hanif (2010) who found weak policy coordination in Pakistan; Tarawalie *et al.* (2013) who found weak policy coordination among West African Monetary Zone countries; Abdel-Haleim (2016) and Oboh (2017) who found weak policy coordination in Nigeria, and Rugea (2018) who also found a weak level of policy coordination in Romania. These researchers investigate the degree of policy coordination for single countries. This is a theoretical approach applied to categorical data and these researchers applied it due to data limitations in these countries. Because of its abstract nature, the STA is applied only as a secondary analysis to supplement the main analysis of policy reaction functions.

One of the contributions of this study is the extension of the set-theoretic approach to policy coordination between two countries at a time, where South Africa, a dominant country in the SACU region, is one of the countries. Unlike the EMU that has measures in place to promote monetary and fiscal policy coordination, the SACU countries do not have such standards, which means that there are no prescribed coordination measures of monetary and fiscal policy in the SACU region. Therefore, for this study, coordination refers to a scenario where monetary and fiscal policies move in the same direction, i.e. either both expansionary and/or both contractionary.

#### 2.2.4. Empirical literature

The interaction between monetary and fiscal policies has been empirically analysed for single countries,<sup>31</sup> and for a group of countries.<sup>32</sup> These researchers applied a wide range of modelling approaches and frameworks to investigate the interaction between monetary and fiscal policies, including dynamic (structural) stochastic general equilibrium (DSGE) and New Keynesian models, cointegration and vector autoregressive (VAR) models. The researchers that have used DSGE models,<sup>33</sup> measure welfare effects of policy coordination in terms of aggregate utility, the possible gains from the coordination of monetary and fiscal policies and the extent and effectiveness of monetary and fiscal policies. Furthermore, Blueschke and Neck (2015) and Michalak *et al.* (2009) calibrate a stylised macroeconomic model of a monetary union to analyse the interactions between monetary and fiscal policymakers. They conclude that coordination between monetary and fiscal policymakers is important in economic stabilisation.

A few researchers incorporated game-theoretic modelling to their empirical analysis of the monetary and fiscal policy interactions. These include Engwerda, Boldea, Michalak, and Plasmans (2012), who estimate a stylised open-economy dynamic general equilibrium model for the ASEAN countries using a game theory approach. They find that the coordination of policies brings substantial gains to economies. Similarly, Saulo *et al.* (2013) and Kappel and Janku, (2014) each developed a model using game theory and testing it empirically using multivariate regression analysis. These authors also find that coordination is more beneficial for economies than non-coordination. Fragetta and Kirsanova (2010) and Merzlyakov (2012) find that a cooperative Stackelberg interaction, with fiscal leadership, is an effective strategy for the interaction between monetary and fiscal policies, while Blueschke and Neck (2015) find that monetary leadership is more effective.

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<sup>31</sup> For example, Favero and Monacelli, 2003; Saulo *et al.*, 2013; Bertella, Rego, Neris Jr, Silva, Podobnik and Stanley, 2015; Daly, 2015; Kuncoro, 2015; Cazacu, 2015; Mallick and Sethi, 2016; Shahid, Qayyum and Shahid, 2016; Xu and Serletis, 2016; Rezabek and Doucek, 2018; Yuan and Nuryakin, 2018

<sup>32</sup> For example, Melitz, 2000; Janku and Kappel, 2014; Daly and Smida, 2014; Nguyen, 2015; Jawadi, Mallick and Sousa, 2016; Kliem, Krowoluzky and Sarferaz, 2016; Hounghbedji, 2017; Blagrave, Ho, Koloskova and Vesperoni, 2018; Afonso, Alves and Balhote, 2019

<sup>33</sup> Include Lombardo and Sutherland (2004), Muscatelli, Tirelli and Trecroci (2004), Bofinger and Mayer (2004), Leith and von Thadden (2006), Koenig and Zeneloglu (2008), Kliem *et al.* (2016), Bhattarai and Mallick (2016), and Shahid *et al.* (2016).

In addition, some researchers<sup>34</sup> use VAR models to examine the interaction between the monetary and fiscal policies. The VAR models typically consist of macroeconomic (policy target) variables such as output and inflation as well as policy (instrument) variables representing the fiscal and monetary policy stance. Findings from the VAR studies above show that the monetary and fiscal policies conflict as they move in opposite directions in the different countries studied (for example, US, India, Euro area countries and the Czech Republic). These findings suggest that there is still room to enhance the effectiveness of the interaction between monetary and fiscal policies.

Considering that this study looks at monetary union member countries, it is essential to consider the country-size asymmetry when analysing the monetary and fiscal policy interactions, because this asymmetry may crucially affect the nature of these policy interactions (Machado, 2007). In most cases, the dominant economy would influence the extent of policy coordination (Vieira *et al.*, 2018). Moreover, government debt levels are also a factor that can crucially shape the nature of policy coordination in a monetary union. Vieira *et al.* (2018) show that in countries with high debt levels during the EMU sovereign debt crisis, welfare costs of non-coordination between the common monetary policy and decentralised fiscal policies were higher than if the policies were coordinated.

The interaction of monetary and fiscal policies also depends on the kind of shocks that hit these member countries (Flotho, 2012b). According to Muscatelli *et al.* (2004), monetary and fiscal policies are complementary in the case of output shocks and act as substitutes in the case of inflation shocks. Better policy coordination is required to alleviate demand shocks that hit economies and to avoid growing imbalances between monetary and fiscal policies in the future (Bhattarai and Mallick, 2016). Moreover, monetary and fiscal policy coordination is desirable when a highly integrated region is subjected to a common (symmetric) shock and is undesirable when faced with a country-specific (asymmetric) shock (Di Bartolomeo *et al.*, 2005; Beetsma, Debrun, and Klaassen, 2001).

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<sup>34</sup> Muscatelli *et al.* (2004), Van Aarle, Garretsen and Gobbin (2003), Semmler and Zhang (2004), Raj, Khundrakpam and Das (2011), Reade (2011), Daly and Smida (2014), Bhattarai and Mallick (2016), Hounghbedji (2017), and Rezabek and Doucek (2018)

Therefore, because there are reduced conflicts between monetary and fiscal authorities as they respond to the shock, monetary and fiscal policy coordination among countries improves macroeconomic performance of these economies when a common shock hits them.

The main perspectives gained from the above literature discussion are that the interaction between monetary and fiscal policy involves determining whether or not the policies are coordinated, complementary or substitutes to one another and either react or do not react to each other (Wyplosz, 1999). Moreover, the nature and scope of policy coordination largely depend on the types of shocks hitting the region and the objective functions of the policymakers (Muscatelli *et al.*, 2004).

The main conclusion is that without efficient policy coordination between monetary and fiscal policies, price instability could harm economic growth while efficient coordination of monetary and fiscal policies will only be possible if the need for policy sustainability and credibility is taken into account (Daly and Smida, 2014). One of the implications from the EMU literature is that, due to the policy interdependence within the union, the actual interaction in the EMU is one in which policymakers set their policies anticipating the response of the other.

The literature on monetary and fiscal policy interactions indicates that coordination between the policies is an ideal setup that contributes towards maintaining price stability in the monetary union. As much as monetary and fiscal authorities have different policy objectives, the policy decisions can be in mutual harmony, with one policymaker considering the policy actions of the other. Additionally, the outcomes of coordination between monetary and fiscal policies depend on economic structures of member countries, the shocks that hit the economies, the nature of the spillover effects, and the policy objectives of the fiscal and monetary authorities. Lastly, coordination of monetary and fiscal policies can mostly be beneficial to the economic welfare of member countries. Therefore, this article investigates the extent of monetary and fiscal policy coordination among the SACU countries to establish the need for coordination, which is critical for the management of overall economic wellbeing.

### **3. METHOD**

The main objective of the article is to determine the interaction between monetary and fiscal policies in SACU. The two methods of analysis used in this article are the set-theoretic approach and the estimation of monetary and fiscal policy reaction functions that cater for policy interaction.

#### **3.1. Set-Theoretic Approach (STA)**

The STA is used as a secondary analysis of monetary and fiscal policy coordination in this study. This is because it is a theoretical and qualitative approach that has not been widely applied in this field. However, the main advantage of the approach to measure the extent of coordination between fiscal and monetary policies is an attractive quality and is, therefore used in this study. The STA uses set theory concepts and is well suited to categorical and dimensional data analysis. According to Ramlogan and Sookram (2018), the potential for monetary and fiscal policy coordination arises when the policy-making authorities can pursue their own goals without affecting the other policymaker. Therefore, the first step of the policy coordination analysis in this article is to test whether or not the two policies are independent, using the Granger causality test and the Phillips-Ouliaris cointegration test.

The motivation for the choice of the Phillips-Ouliaris cointegration test is the small sample size given that it is a single equation residual test, which conserves degrees of freedom. Moreover, Ramlogan and Sookram (2018: 9) state that the Phillips-Ouliaris cointegration test adjusts the conventional statistic using the Newey-West estimator of error variance, which is robust to serial correlation and time-dependent heteroscedasticity. The two monetary and fiscal policy instruments used are the policy interest rate and government expenditure, respectively. The Granger causality test explores the impact of one variables' past values on the current value of another, whereas the cointegration test determines the existence of a long-run relationship between the policy interest rate and government expenditure. Monetary and fiscal policies are independent if there is no pairwise causality and no cointegration between the two policy stances. If there is independence, the next step is to calculate the degree of policy coordination using the set-theoretic approach (STA).

The STA involves the construction of two matrices, the macroeconomic environment matrix and the policy response matrix (Oboh, 2017). Table 1 presents the macroeconomic environment matrix. The macroeconomic matrix shows that there are four possible economic shock scenarios.

Table 1: Macroeconomic environment matrix

		Shocks to inflation (Monetary policy target)	
		Positive (P)	Negative (N)
Shocks to growth (Fiscal policy target)	Positive (P)	PP	PN
	Negative (N)	NP	NN

As highlighted by Rugea (2018), the STA is purely a theoretical and qualitative approach with no econometric inclination. What makes this method theoretical is how it defines and categorises shocks as well as policy targets. Shocks identified in this study are those that cause output growth and inflation to deviate from their long-run trends (Englama, Tarawalie and Ahortor, 2014; Oboh, 2017). Thus, the shocks referred to in this STA application are not the standard shocks defined in econometrics where a shock is derived from the error terms of an equation. The output gap in this study refers to the deviation of actual output from the potential output, while the inflation shock is measured as the deviation of actual inflation from potential inflation<sup>35</sup> (Rugea, 2018; Tarawalie *et al.*, 2013). A negative (positive) gap value represents a negative (positive) shock to the policy target. According to Oboh (2017), output growth is referred to as the fiscal policy target, while inflation is the monetary policy target.

Table 1 indicates that at any given time, the economy experiences two shocks, i.e. a shock to growth and a shock to inflation, which gives rise to four possible scenarios of shock combinations that hit the economy. Two of these scenarios are conditions where the economic growth and inflation shocks are either both positive (PP) or both negative (NN). The other possible scenarios are the conflicting shocks to growth and inflation, where a positive shock hits one policy target, and another is hit by a negative shock (PN and NP). For each of the economic growth and inflation shocks discussed above, there is an associated fiscal and monetary policy response, respectively. The policy response matrix in Table 2 indicates the ideal policy response for a particular macroeconomic environment.

<sup>35</sup> Other studies measure a shock to growth as differences between observed real GDP growth from the sample mean (Oboh, 2017), while a shock to inflation is the deviation of observed inflation from the threshold rate (Oboh, 2017; Tarawalie *et al.*, 2013; Englama *et al.*, 2014).



Table 2: Policy response matrix

		Monetary policy response	
		Contractionary (C)	Expansionary (E)
Fiscal policy response	Contractionary (C)	CC	CE
	Expansionary (E)	EC	EE

At a time of the economic growth and inflation shocks, there is an associated policy response. There will be a fiscal policy response to economic growth shock and a monetary policy response to an inflation shock, which means that fiscal policy responds to economic growth shocks and monetary policy responds to inflation shocks (Oboh, 2017; Arby and Hanif, 2010).

These policy responses are either contractionary or expansionary, and this gives rise to four possible policy response combinations: both policies are expansionary (EE), or both policies are contractionary (CC), or one policy is expansionary, and the other is contractionary (EC and CE). The policymakers use countercyclical monetary and fiscal policies to respond to the shocks that hit the economy. For a countercyclical policy, the appropriate responses to positive shocks in inflation and growth are the contractionary monetary and fiscal policies respectively, since they dampen excess demand caused by increased growth and rising inflation (Rugea, 2018). Likewise, the proper countercyclical policy responses to negative inflation and negative growth shocks are expansionary monetary and fiscal policies, respectively. These policies attempt to stimulate aggregate demand and inflation.

The extent of coordination is obtained from the information in Tables 1 and 2, by matching a shock that hits the economy to an appropriate policy response and using the following equation:

$$\rho = \omega/n \tag{1}$$

Where  $\omega = n(PP \cap CC) + n(PN \cap CE) + n(NP \cap EC) + n(NN \cap EE)$  and  $n$  = number of years included in the analysis. When  $\rho \leq 0.5$  there is weak coordination;  $\rho > 0.5$  indicates strong coordination;  $\rho = 1$  represents perfect coordination; and  $\rho = 0$  represents no coordination.

One of the contributions in this article is the extension of the set-theoretic approach to measure the extent of policy coordination between South African and BLNS countries.

The line of argument is that if there are spillovers in the inflation and growth shocks from South Africa to the BLNS countries, then the BLNS country policies are, in essence, responding to the South African shocks. Moreover, the South African macroeconomic environment shocks are compared with those of the BLNS countries, to establish whether or not a positive (negative) shock in the inflation (or growth) in a BLNS country follows from the South African positive (negative) inflation (or growth) shock. In other words, the question is whether or not the two economies are both hit by positive (or negative) shocks in the same period (year). If so, this could be an indication of some correlation between the shocks. The assessment of the correlation of shocks involves counting the proportion of years where the South African inflation and growth shocks correspond with those of the BLNS countries. That is, the relevant years calculated are those with positive (or negative) shocks for both South Africa and each of the BLNS countries. A proportion of more than 50% of the years with common shocks is an indication of similar macroeconomic environments between South Africa and the BLNS countries.

The evidence of the South African dominance hypothesis established in Article 1 will then point towards the notion that some of the inflation and growth shocks hitting the BLNS countries are due to spillover effects of shocks hitting South African inflation and growth. Once the shock spillovers have been established, the set-theoretic approach then uses the South African macroeconomic environment matrix and the policy response matrix of the BLNS country in question. To capture the extent of coordination between South Africa and BLNS countries' monetary and fiscal policies, the focus is on how the policies of the BLNS countries respond to the South African macroeconomic shocks in a particular year.

In comparing the shocks to the appropriate policy responses, the policymakers would most likely respond to the economic shocks in the following period. Therefore, another contribution of this article is the extension of the STA applied by, among others, Arby and Hanif (2010), Oboh (2017), and Englama *et al.* (2014) to account for the lagged policy responses to shocks that hit the economy. The extent of policy coordination is calculated by matching the South African macroeconomic environment shocks to the appropriate policy responses of the BLNS countries in the year after the particular shock.

As much as this is a theoretical approach, this study considers lags because the policymakers tend to respond to a shock in the subsequent period.

### **3.2. Policy reaction functions**

Furthermore, to supplement the set-theoretic approach, the interactions between monetary and fiscal policy are analysed using policy reaction functions, following Kappel and Janku (2014) and Hallett, Libich, and Stehlik (2014). The policy reaction functions describe the behaviour of policy authorities in pursuit of their objectives as well as looking at how one policy instrument affects the instrument of the other policy. The monetary authority is the central bank, and the fiscal authority is the government. The economic behaviour and decisions of the policy authorities can be presented by a simple stylised model of policy mix which includes an IS curve and a Phillips curve (Duchassaing and Gagnol, 2000; Lubik and Schorfheide, 2007). The IS curve, also known as the aggregate demand function, represents the output gap as a function of the short-term interest rate, the fiscal variable, and control variables (if any):

$$y_t^j = \alpha_0 + \alpha_1 y_{t-1}^j + \alpha_2 i_{t-1}^j + \alpha_3 g_t^j + \alpha_4 \sum_{k=0}^1 y_{t-k}^{SA} + \alpha_5 g_t^{SA} + \alpha_6 i_{t-1}^{SA} + \alpha_7 Z + \varepsilon_t^j \quad (2)$$

where  $j$  is the BLNS country  $j$ ,  $y_t^j$  is the output gap,  $i_t^j$  is the short-term interest rate,  $g_t^j$  is the fiscal policy variable, and  $Z$  represents control variables. Moreover,  $\alpha_i$  and  $\varepsilon_t^j$  are the equation parameters and country-specific demand shocks, respectively. The Phillips curve represents inflation as a function of the output gap and control variables (if any):

$$\pi_t^j = \beta_0 + \beta_1 \pi_{t-1}^j + \beta_2 y_t^j + \beta_3 \pi_{t-1}^{SA} + \beta_4 y_t^{SA} + \beta_5 Z + \mu_t^j \quad (3)$$

where  $\pi_t^j$  is the inflation rate,  $\mu_t^j$  is the country-specific supply shocks and  $\beta_i$  represent the equation parameters. One of the contributions of the study is that these equations have been adapted to include South African variables as independent variables in the other SACU member countries. The inclusion of South African variables captures policy spillovers into the other SACU member countries (Auerbach and Gorodnichenko, 2013). Hence,  $y_{t-k}^{SA}$ ,  $g_t^{SA}$  and  $i_{t-1}^{SA}$  are the South African output gap, fiscal policy variable and interest rate, respectively.

Equations (2) and (3) above represent the structure of the economy and the variables controlled by the monetary and fiscal policy authorities.

Between the IS and backward-looking Phillips curves, the interest rate affects output with a one-period lag, while it takes output another period to influence inflation, i.e. two periods from the interest rate to inflation. The micro-foundations for these equations assume that households seek to maximise consumption subject to their budget constraints and firms produce differentiated goods and set prices in a staggered manner (Kirsanova *et al.*, 2005; Gali and Monacelli, 2008; Fragetta and Kirsanova, 2010). Also, the output gap and inflation are the fiscal and monetary policy target variables included in the loss functions of these policy authorities (Reade, 2011; Saulo *et al.*, 2013):

$$L^k = 0.5[(1 - \delta)\hat{y}^2 + \delta\hat{\pi}^2] \quad (4)$$

where  $k$  denotes the monetary or fiscal authority, and  $\delta$  and  $1 - \delta$  represent the relative weights that each authority places on stabilising inflation and output, respectively.

The monetary and fiscal authorities then derive their policy reaction functions by minimising their loss functions subject to the structure of the economy (Flotho, 2012b; Saulo *et al.*, 2013). In general, a policy reaction function has the dependent variable as the main policy instrument and the independent variables as the policy instrument of the other authority and other selected economic variables such as output gap, inflation, exchange rate and long-term interest rate. The monetary and fiscal policy reaction functions to be estimated in this article are as follows (Janku and Kappel, 2014; Davig and Leeper, 2009; Melitz, 2000; Wyplosz, 1999):

$$i_t^j = \gamma_0 + \gamma_1\pi_t^j + \gamma_2y_{t-1}^j + \gamma_3g_t^j + \gamma_4\pi_t^{SA} + \gamma_5y_{t-1}^{SA} + \gamma_6g_t^{SA} + \gamma_7Z + \varepsilon_t \quad (5)$$

$$g_t^j = \rho_0 + \rho_1g_{t-1}^j + \rho_2d_{t-1}^j + \rho_3y_{t-1}^j + \rho_4i_t^j + \rho_5g_{t-1}^{SA} + \rho_6d_{t-1}^{SA} + \rho_7y_{t-1}^{SA} + \rho_8i_t^{SA} + \varepsilon_t \quad (6)$$

Equations (5) and (6) show how the policy authorities react to economic conditions and each other.

Table 3: Expected signs

Variable	Expected sign
<b>Fiscal policy</b>	
Government expenditure lag	+
Output	-
Debt lag	-
Monetary policy instrument	- coordination/ + conflict
Inflation	+/-
<b>Monetary policy</b>	
Monetary policy lag	+
Output	+
Fiscal policy instrument	- coordination/ + conflict
Inflation	+
Exchange rate	-

Equation (5) is the monetary policy reaction function where the policy instrument is the short-term interest rate, while equation (6) is the fiscal policy reaction function where the policy instrument is government expenditure. Table 3 shows the *a priori* signs of the main economic variables for the two reaction functions.

In the monetary policy reaction function, the output gap is positively related to the short-term interest rates where an increase in the output gap is associated with an increase in the interest rate. One of the independent variables in the monetary policy reaction function is inflation, and it is expected to have a positive effect on the monetary policy rate, i.e., if there is an increase in inflation, the central bank must respond by increasing the policy interest rate. Government expenditure is also included and can have either a negative or positive relationship with monetary policy. A positive relationship indicates a conflict between monetary and fiscal policy, because an expansionary (contractionary) fiscal policy is associated with a contractionary (expansionary) monetary policy. A negative relation indicates coordination between the two policies, because an expansionary (contractionary) fiscal policy is associated with an expansionary (contractionary) monetary policy.

Furthermore, government expenditure is the fiscal policy instrument in the fiscal policy reaction function and can be affected by debt, the output gap and the monetary policy instrument. A negative relation is expected between debt and government expenditure. If the total debt increases, government expenditure should go down to prevent a further rise in debt. The output gap is expected to have a negative effect on government expenditure, which indicates a counter-cyclical fiscal policy.

For example, if there is a positive output gap, the government would reduce its expenditure and vice versa. Persistence of government expenditure is expected through the lagged government expenditure, which means that there is a partial effect of the fiscal policy instrument in one period and, in the following period, further adaptation occurs. The monetary policy instrument can have either a negative or positive relationship with government expenditure. A negative sign indicates coordination between the two policies as they complement each other, while a positive relationship suggests that the two policies are in conflict and act as substitutes to each other.

Equations (2), (3), (5) and (6) summarise the economic conditions of each member country of the monetary union as well as the description of fiscal and monetary policy (Flotho, 2012b; Kirsanova *et al.*, 2005). When put together the equations make up a simple open economy structural model based on New Keynesian macroeconomic properties. Examples include Lubik and Schorfheide (2007), Fragetta and Kirsanova (2010), Caraianni (2012), Flotho (2012b), Cebi (2012), Ma and Li (2015), and Chen, Leeper and Leith (2015).

Because fiscal policy data are only available on an annual basis, thus limiting the number of observations available for analysis, the focus in this article is on the estimation of simple policy reaction equations. The reaction functions above will be estimated using OLS and general-to-specific (GETS) modelling (Hendry and Krolzig, 2005). GETS modelling is used to separate relevant explanatory variables from irrelevant ones. The main steps involved in the Gets procedure include (Hendry and Krolzig, 2005):

- Formulation of the initial general unrestricted model (GUM) where all the possible variables are included.
- Specifying selection criteria based on forms of misspecification tests and their significance levels (e.g. residual autocorrelation) as well as the desired information criterion for selecting a parsimonious model (e.g. Akaike Information Criterion)
- Estimating the GUM appropriately (using least squares method or instrumental variables). Also, check that the GUM captures the essential characteristics of the data by evaluating the misspecification tests and remove the insignificant variables.

- Carry out pre-search reductions at a loose significant level and then estimate a new baseline GUM for the remaining stages.
- To avoid path dependence, commence the multiple-path reduction searches for each feasible initial deletion. A specific model is selected when all reductions and diagnostic tests are acceptable, and all remaining variables are significant.
- Check the reliability of the final selection by choosing an appropriate significance level.

The six steps above are carried out by Autometrics in the PcGive software, which is an automatic model selection algorithm tool.

#### **4. DATA AND RESULTS**

The variables used in this article are measured annually and cover data ranging from 1960 to 2017, depending on the availability of the data. The source of the data is the IMF IFS database. Though included in the STA, Namibia is removed from the policy reaction function analysis due to a too small number of observations. Real GDP represents a measure of output and is logged. GDP is detrended using the Hodrick-Prescott filter to estimate the output gap<sup>36</sup> (e.g. Dungey and Fry, 2003). Table 4 presents the data available and the period of availability. Inflation is calculated as the year-on-year change in the log of a GDP deflator. Moreover, the discount rate is the nominal short-term interest rate used as a proxy for the monetary policy rate. Debt and government expenditure measures are ratios of GDP. Government expenditure is the fiscal policy instrument. The exchange rate for Botswana is the rand-pula rate, while the exchange rate for Lesotho, Namibia, and Swaziland is the rand-dollar rate.

Before doing any analysis, stationarity tests were done to determine the order of integration of the variables used in the analysis and the results are in the appendix. All the monetary policy rates are stationary, except for Namibia.

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<sup>36</sup> Following the method used by Kaiser and Maravall (1999), observations were extended by three years (12 observations for quarterly data) at the beginning and the end of the sample in an attempt to deal with the end-of-sample problem of the HP filter method.

Table 4: Sample information

Variable (country)	Date	Sample size
GDP (SA)	1960 – 2017	58
GDP (B)	1960 – 2017	58
GDP (L)	1960 – 2017	58
GDP (N)	1980 – 2017	38
GDP (S)	1970 – 2017	48
Policy rate (SA)	1960 – 2017	58
Discount rate (B)	1976 – 2017	42
Discount rate (L)	1980 – 2017	38
Discount rate (N)	1991 – 2017	27
Discount rate (S)	1976 – 2017	42
Inflation (SA)	1960 – 2017	58
Inflation (B)	1960 – 2017	58
Inflation (L)	1960 – 2017	58
Inflation (N)	1978 – 2017	40
Inflation (S)	1968 – 2017	50
Government expenditure (SA)	1960 – 2017	58
Government expenditure (B)	1960 – 2017	58
Government expenditure (L)	1960 – 2017	58
Government expenditure (N)	1977 – 2017	41
Government expenditure (S)	1960 – 2017	58
Debt (SA)	1960 – 2017	58
Debt (B)	1969 – 2017	49
Debt (L)	1970 – 2017	48
Debt (N)	1990 – 2017	28
Debt (S)	1967 – 2017	51
Exchange rate (R/P)	1960 – 2017	58
Exchange rate (R/\$)	1960 – 2017	58
Government bond yield (SA)	1960 – 2017	58

Government expenditure for Botswana, Namibia and Swaziland are stationary, while those of Lesotho and South Africa are integrated of order one. Inflation and GDP are all gap variables and are, therefore, by construction, stationary.

#### **4.1. Set-theoretic approach results**

In a theoretical analysis of policy coordination using the set-theoretic approach, four variables are used: gross domestic product (GDP), inflation, government expenditure and short-term interest rate, which represent fiscal policy and monetary policy targets



and fiscal policy and monetary policy instruments respectively. A change in the short-term interest rate represents the monetary policy stance, where an increase (decrease) in the interest rate indicates contractionary (expansionary) monetary policy (Arby and Hanif, 2010). A change in government expenditure represents the fiscal policy stance where an increase (decrease) in government expenditure indicates expansionary (contractionary) fiscal policy (Ramlogan and Sookram, 2018).

Table 5: Granger causality test results

Country	Null hypothesis	F statistic	p-value
SA	SA government expenditure does not Granger cause SA monetary policy rate	2.796	0.100
	SA monetary policy rate does not Granger cause SA government expenditure	0.189	0.667
B	Botswana government expenditure does not Granger cause Botswana monetary policy rate	0.596	0.556
	Botswana monetary policy rate does not Granger cause Botswana government expenditure	1.483	0.241
L	Lesotho government expenditure does not Granger cause Lesotho monetary policy rate	0.020	0.888
	Lesotho monetary policy rate does not Granger cause Lesotho government expenditure	0.190	0.665
N	Namibian monetary policy rate does not Granger cause Namibian government expenditure	0.653	0.428
	Namibian government expenditure does not Granger cause monetary policy rate	0.226	0.639
S	Swaziland government expenditure does not Granger cause Swaziland monetary policy rate	0.367	0.548
	Swaziland monetary policy rate does not Granger cause Swaziland government expenditure	0.556	0.461

Note: \* - Up to 3 lags were tested and the results are similar. To conserve space, only results for 1<sup>st</sup> lag were reported

For the STA to apply, the fiscal and monetary policies must be operationally independent. In other words, the policy interest rate and government expenditure must not be cointegrated, and there must not be causality between them. Hence, a preliminary analysis to determine the independence of policies is done on the policy interest rate and government expenditure. Because the policy interest rates and government expenditures for all the countries have different orders of integration, cointegration analysis could not be done and the policies are not cointegrated. Thus, only the Granger causality test is applied. The stationary variables were used as they are in the Granger causality, while the I(1) variables had to be first differenced to render them stationary.

Table 5 presents the Granger causality results, and the results show that in all five countries none of the short-term interest rates contributes to government expenditure, while government expenditure also does not Granger cause short-term interest rates. In other words, there is no Granger causality between the monetary policy rates of each of the SACU countries and the countries' own government expenditures.

Table 6: Macroeconomic environment matrices for SACU countries

Country	Shocks to growth (Fiscal policy target)	Shocks to inflation (Monetary policy target)	
		Positive (P)	Negative (N)
B	Positive (P)	1978, 1979, 1988, 1989, 1999, 2000, 2014	1980, 1983, 1990, 1991, 1992, 1997, 2006, 2007, 2008, 2013
	Negative (N)	1984, 1985, 1986, 1993, 1996, 1998, 2004, 2005, 2010, 2011, 2016, 2017	1977, 1981, 1982, 1987, 1994, 1995, 2001, 2002, 2003, 2004, 2010, 2017
L	Positive (P)	1991, 1992, 1995, 1998, 2001, 2008, 2011, 2013, 2014, 2015	1993, 1994, 1996, 1997, 2010, 2012, 2016
	Negative (N)	1985, 1986, 1988, 1989, 2002, 2004, 2006	1981, 1982, 1983, 1984, 1987, 1990, 1999, 2000, 2003, 2005, 2007, 2009, 2017
N	Positive (P)	1996, 2006, 2007, 2008, 2013	1992, 1993, 1995, 1997, 1998, 2004, 2005, 2014, 2015
	Negative (N)	1994, 2000, 2001, 2002, 2009, 2012, 2016	1999, 2003, 2010, 2011, 2017
S	Positive (P)	1982, 1990, 1993, 1995, 2008, 2014, 2015	1977, 1981, 1989, 1991, 1992, 1994, 1996, 1997, 2005, 2006, 2007, 2013, 2016,
	Negative (N)	1978, 1979, 1984, 1986, 1988, 2000, 2009, 2012	1980, 1983, 1985, 1987, 1998, 1999, 2001, 2002, 2003, 2004, 2010, 2011, 2017
SA	Positive (P)	1966, 1969, 1974, 1980, 1989, 1990, 2007, 2008, 2011, 2013	1964, 1965, 1967, 1968, 1970, 1971, 1975, 1981, 1982, 1984, 1988, 1996, 1997, 2005, 2006, 2012, 2014, 2015
	Negative (N)	1961, 1963, 1972, 1973, 1979, 1983, 1985, 1986, 1991, 1992, 1993, 2000, 2002, 2009, 2016	1962, 1976, 1977, 1978, 1987, 1994, 1995, 1998, 1999, 2001, 2003, 2004, 2010, 2017

Note: The numbers represent the calendar years

Based on the above results, the monetary and fiscal policy indicators are independent, and we can determine the extent of the policy coordination between the policies. The calculation of policy coordination in this study involves establishing the degree of policy coordination within each of the SACU countries (domestic policy coordination), as well as policy coordination between SA and each of the BLNS countries. For domestic policy coordination, the macroeconomic environment and the policy response matrices for the respective countries are used. Table 6 presents the macroeconomic environment matrices for each of the SACU countries.

For the period under study, negative inflation shocks and positive growth shocks mostly dominated the South African, Namibian and Swaziland macroeconomic environments. Negative growth shocks dominated Botswana and Lesotho macroeconomic environments. Moreover, the Botswana macroeconomic environment was dominated by positive inflation shocks, while negative inflation shocks dominated Lesotho.

Table 7: Policy response matrices for SACU countries

Country	Fiscal policy response	Monetary policy response	
		Contractionary (C)	Expansionary (E)
B	Contractionary (C)	1999, 2000, 2002, 2004, 2005, 2006	1978, 1979, 1980, 1983, 1984, 1985, 1988, 1989, 1996, 2001, 2003, 2010, 2011, 2013, 2016, 2017
	Expansionary (E)	1981, 1982, 1990, 1991, 1992, 1993, 1998, 2008	1977, 1986, 1987, 1994, 1995, 1997, 2007, 2009, 2012, 2014, 2015
L	Contractionary (C)	1981, 1982, 1983, 1984, 1988, 2015, 2016	1987, 1992, 1993, 2010, 2011, 2013
	Expansionary (E)	1989, 1991, 1995, 1996, 1998, 2002, 2007, 2008, 2012, 2014	1985, 1986, 1990, 1994, 1997, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2009, 2017,
N	Contractionary (C)	1996, 1997, 1998, 2002, 2008, 2015, 2016, 2017	1993, 1994, 2000, 2001, 2004, 2005, 2011
	Expansionary (E)	1995, 2003, 2006, 2007, 2014	1992, 1999, 2009, 2010, 2012, 2013
S	Contractionary (C)	1981, 1982, 1984, 1988, 1989, 1990, 1994, 1995, 1998, 2002, 2017	1979, 1983, 1986, 1987, 1992, 1999, 2000, 2005, 2010, 2011, 2012
	Expansionary (E)	1977, 1991, 1996, 2006, 2007, 2008, 2014, 2015, 2016	1978, 1980, 1985, 1993, 1997, 2001, 2003, 2004, 2009, 2013
SA	Contractionary (C)	1967, 1977, 1988, 1989, 1995, 1998, 2006, 2007, 2015	1963, 1972, 1973, 1979, 1980, 1983, 1999, 2000, 2011
	Expansionary (E)	1961, 1964, 1965, 1966, 1971, 1974, 1975, 1976, 1981, 1982, 1984, 1990, 1996, 1997, 2002, 2008, 2014, 2016	1962, 1968, 1969, 1970, 1978, 1985, 1986, 1987, 1991, 1992, 1993, 1994, 2001, 2003, 2004, 2005, 2009, 2010, 2012, 2013, 2017

Note: The numbers represent the calendar years

The macroeconomic environment matrices in Table 6 are paired with the corresponding policy response matrices in Table 7 to measure the extent of domestic policy coordination within each of countries as well as between South Africa and the BLNS countries. The extent of policy coordination is calculated by pairing the macroeconomic environment matrices with the corresponding contemporaneous and lagged policy responses in Table 7.

Lagged policy responses are used in this study to account for the delayed response to an economic shock, because, technically, policy authorities react to an economic shock, a period after it has occurred, and not in the same period.

The most prevalent policy mixes for Botswana are expansionary monetary policy and contractionary fiscal policy; for Swaziland, contractionary for both monetary and fiscal policy; while South Africa and Lesotho, the most prevalent policy mixes are expansionary monetary and fiscal policies during the period under study. The policy mix for Namibia was contractionary monetary and fiscal policies.

Table 8 presents the measures of domestic policy coordination for each of the SACU countries. Two measures of policy coordination are reported, where one is the coordination measure using the original STA method and the other is the measure using the modified method of the STA, which accounts for lagged policy responses. The extent of domestic policy coordination in the SACU countries ranges from 7.5% for Botswana to 32% for Namibia. These results show that the SACU countries have weak coordination between monetary and fiscal policies in their respective countries.

Table 8: Domestic policy coordination for SACU countries

Country	$\rho_i$ (STA)	$\rho_i$ (STA lagged)
<b>B</b>	$13/41 = 31.7\%$	$3/40 = 7.5\%$
<b>L</b>	$12/37 = 32.4\%$	$10/36 = 27.78\%$
<b>N</b>	$7/26 = 26.9\%$	$8/25 = 32\%$
<b>S</b>	$10/41 = 24.4\%$	$4/40 = 10\%$
<b>SA</b>	$14/57 = 24.6\%$	$9/56 = 16.07\%$

Note: the coordination measures denoted  $\rho_i$  (STA) are only included for comparability.

A point to note is that even South Africa, the dominant economy in the SACU region, also exhibits weak policy coordination. Weak policy coordination could result from the lack of formalised arrangements ensuring proper communication between authorities. Suggested measures that can be taken by the SACU countries to promote greater policy coordination include the need to strengthen the relationship between the monetary and fiscal authorities as well as the need to ensure proper public debt management, considering that high public debt levels can hamper coordination with monetary policy (Ramlogan and Sookram, 2018).

In addition to measuring domestic policy coordination, this study extends to measuring the degree of policy coordination between South Africa and each of the BLNS countries. The approach uses the South African macroeconomic environment and the policy response matrix of the BLNS country in question.

Table 9 presents the proportion of years where the BLNS countries have symmetric inflation and growth shocks with South Africa. These proportions are determined by comparing the years in which South Africa and each of the BLNS countries have the same growth shocks, inflation shocks, and fiscal policy stance as well as monetary policy stance. Table 9 indicates that all the BLNS countries experience the same inflation and economic growth shocks as South Africa for more than 50% of the years. In other words, South Africa and the BLNS countries experience positive (or negative) inflation and economic growth shocks simultaneously, more than 50% of the years included in the study.

Table 9: Frequency and proportions of the years where there are symmetric inflation and growth shocks and policy stances

Country	Growth shocks	Inflation shocks	Fiscal policy	Monetary policy
<b>B</b>	30/58 (51.7%)	30/58 (51.7%)	32/57 (56.1%)	23/41 (56.1%)
<b>L</b>	29/58 (50%)	34/58 (58.6%)	31/57 (54.4%)	31/37 (83.8%)
<b>N</b>	25/38 (65.8%)	24/40 (60%)	22/40 (55%)	24/26 (92.3%)
<b>S</b>	33/48 (68.8%)	25/48 (52.1%)	29/57 (50.9%)	37/41 (90.2%)

Note: Numerator is the number of years with common shocks and policy stances between SA and the BLS country.

Also, the South African policy stance is the same as the BLNS policy stances (i.e. contractionary [expansionary] fiscal policy in both SA and the BLNS countries and contractionary [expansionary] monetary policy in both SA and the BLNS countries) for more than fifty percent of the years included in the study. Therefore, based on the structure of the shocks, policy stances, as well as the evidence for South Africa dominance hypothesis, this current study analyses the coordination between South African and the BLNS countries' policies using the South African macroeconomic environment and the policy stance of the BLNS countries.

Results obtained from the matrices in Table 10 indicate that the extent of policy coordination between South Africa and the BLS countries ranges from 8% to 20%. These values mean that there is weak policy coordination over the period under study. Weak policy coordination may complicate macroeconomic management in the SACU region.

These results are in line with the measures of domestic policy coordination, which indicate weak coordination between monetary and fiscal policy in each of the SACU countries. Based on these findings, the SACU countries could consider improving policy coordination within their borders before focusing on improved policy coordination with South Africa.

Table 10: Policy coordination between South Africa and the BLNS countries

Country	$\rho_i$ (STA)	$\rho_i$ (STA lagged)
B	$11/41 = 26.8\%$	$8/40 = 20\%$
L	$8/37 = 21.6\%$	$7/36 = 19.44\%$
N	$3/26 = 11.5\%$	$2/25 = 8\%$
S	$10/41 = 24.4\%$	$5/40 = 12.5\%$

Note: the coordination measures denoted  $\rho_i$  (STA) are only included for comparability.

#### **4.2. Policy reaction functions results**

The monetary and fiscal policy reaction functions were examined separately as single-equation models for each of the BLS countries. The variables included in the GUM specification are monetary policy rate, inflation, the output gap, government expenditure, and debt for the BLS country and South Africa. All the variables included are stationary, where the I(1) variables are first differenced to make them stationary. Table 11 presents the results of the monetary policy reaction functions.

The monetary policy function results show that monetary policy in the BLS countries responds positively to changes in the South African monetary policy rate. The positive finding is evidence of South African monetary policy spillovers to the smaller SACU countries, and it supports the results found in Article 2. The significant lagged monetary policy rates imply that the monetary policy instrument only has a partial effect with further adaptation occurring in the following period. Domestic inflation is identified as a relevant variable only in the monetary reaction functions of Swaziland and South Africa, with a positive effect on the monetary policy interest rate. Likewise, the South African output gap is statistically significant only in the South African monetary reaction function and has a positive sign. Looking at the significance of the BLS fiscal policy on its monetary policy rate, only Swaziland has a positively significant government expenditure. This is an indication that Swaziland fiscal policy conflicts with its monetary policy.

With respect to the interaction between the BLS monetary policy and South African fiscal policy instruments, the results show that the South African government expenditure does not affect the BLS monetary policies.

Table 11: Monetary policy reaction function results (Dependent variable = policy interest rate)

Independent variable	B	L	S	SA
$i_{t-1}^j$	0.881 <i>0.000</i>	0.694 <i>0.000</i>	-	-
$i_{t-1}^{SA}$	0.110 <i>0.014</i>	0.332 <i>0.000</i>	0.894 <i>0.000</i>	0.723 <i>0.000</i>
$\pi_t^j$	-	-	0.132 <i>0.008</i>	-
$\pi_{t-1}^{SA}$	-	-	-	0.267 <i>0.001</i>
$\hat{y}_{t-1}^{SA}$	-	-	-	0.678 <i>0.001</i>
$g_t^j$	-	-	0.101 <i>0.000</i>	-
$g_t^{SA}$	-	-	-	-
<b>n</b>	40	37	40	40
<b>sigma</b>	0.014	0.015	0.011	0.023
<b>RSS</b>	<i>0.008</i>	<i>0.008</i>	<i>0.004</i>	<i>0.019</i>
<b>Log-likelihood</b>	114.573	100.781	127.082	96.464
<b>Serial correlation test</b>	2.342 <i>0.111</i>	0.203 <i>0.818</i>	0.597 <i>0.556</i>	0.246 <i>0.783</i>
<b>ARCH test</b>	0.060 <i>0.808</i>	1.0002 <i>0.324</i>	1.989 <i>0.167</i>	1.115 <i>0.298</i>
<b>Normality test</b>	3.203 <i>0.202</i>	4.303 <i>0.116</i>	2.163 <i>0.339</i>	0.885 <i>0.642</i>
<b>Heteroscedasticity</b>	0.461 <i>0.764</i>	0.979 <i>0.434</i>	1.409 <i>0.243</i>	1.357 <i>0.262</i>
<b>RESET23 test</b>	0.044 <i>0.957</i>	2.460 <i>0.102</i>	0.235 <i>0.792</i>	0.289 <i>0.982</i>

Note: values in italics are p-values

The possible variables included in the GUM specification for the fiscal reaction functions are inflation, the output gap, exchange rate, and government expenditure for the BLS country. Table 12 presents the estimated results of the fiscal reaction function. The fiscal policy function results indicate that South African government expenditure affects Lesotho's government expenditure, but has no impact on Botswana and Swaziland. This finding is evidence of the positive effect of South African fiscal policy spillovers on the Lesotho fiscal policy. The significant lagged government expenditure implies that the effects of fiscal policy are persistent through to the following period. The high lag value indicates high persistence for fiscal policy.

Moreover, Botswana government expenditure reacts positively to South African output gap and inflation, which means that the fiscal policy authority in Botswana is concerned with the cyclical environment and price dynamics of South Africa when conducting their fiscal policy. The domestic output gap is insignificant for all the countries, which means the BLS fiscal policies do not react to the cyclical conditions of their economies. Previous period debt has a significant effect on government expenditure for Swaziland and South Africa.

Table 12: Fiscal policy reaction function results (Dependent variable = government expenditure)

Independent variable	B	L	S	SA
$g_{t-1}^j$	0.825 <i>0.000</i>	-	0.788 <i>0.000</i>	0.942 <i>0.000</i>
$g_t^{SA}$	-	0.751 <i>0.000</i>	-	-
$\hat{y}_{t-1}^{SA}$	0.299 <i>0.009</i>	-	-	-
$d_{t-1}^j$	-	-	-0.0897 <i>0.007</i>	-0.032 <i>0.007</i>
$\pi_{t-1}^{SA}$	0.371 <i>0.000</i>	-	-	-
$i_t^j$	-0.186 <i>0.009</i>	-	-	-
$i_t^{SA}$	-0.205 <i>0.007</i>	-0.528 <i>0.000</i>	-	-
<b>n</b>	41	37	41	56
<b>sigma</b>	0.012	0.016	0.015	0.006
<b>RSS</b>	0.005	0.008	0.008	0.002
<b>Log-likelihood</b>	126.173	104.229	116.757	208.121
<b>Serial correlation test</b>	0.622 <i>0.543</i>	0.747 <i>0.483</i>	1.983 <i>0.153</i>	3.306 <i>0.145</i>
<b>ARCH test</b>	0.213 <i>0.647</i>	0.368 <i>0.548</i>	0.493 <i>0.487</i>	0.311 <i>0.579</i>
<b>Normality test</b>	2.489 <i>0.288</i>	0.936 <i>0.626</i>	0.163 <i>0.922</i>	2.064 <i>0.356</i>
<b>Heteroscedasticity</b>	0.675 <i>0.474</i>	0.937 <i>0.458</i>	1.171 <i>0.341</i>	0.425 <i>0.790</i>
<b>RESET23 test</b>	1.281 <i>0.292</i>	0.492 <i>0.412</i>	0.080 <i>0.923</i>	0.456 <i>0.637</i>

Note: values in italics are p-values

Such a result is evidence of stable fiscal policy conduct where if debt increases, the government reduces its spending to lower the country's debt liability. Regarding the reaction of fiscal policy to monetary policy, Botswana monetary policy has a significant negative coefficient in Botswana's fiscal reaction function, indicating that there is coordination between domestic monetary policy in Botswana and its domestic fiscal policy.



Moreover, the South African monetary policy rate has a statistically significant negative coefficient in the Botswana and Lesotho fiscal policy reaction functions. Thus, Botswana and Lesotho coordinate their fiscal policies with the South African monetary policy and adjust their fiscal conduct. In other words, the Botswana and Lesotho fiscal policies react to a contractionary (expansionary) South African monetary policy with contraction (expansion) of their fiscal spending. These results indicate coordinated fiscal policy conduct of Botswana and Lesotho with the South African monetary policy.

## **5. CONCLUSION AND POLICY IMPLICATIONS**

Monetary policy and fiscal policy are some of the most important macroeconomic policies. In a monetary union, a common or a dominant central bank sets monetary policy to stabilise inflation while national governments conduct fiscal policy to sustain economic growth. There is *de facto* monetary policy dominance of South Africa in the region, where the smaller SACU countries “follow” South African monetary policy conduct. However, there is currently no forms of monitoring of public finance at a regional level to manage fiscal policy conduct. Also, appropriate fiscal behaviour is essential because “...fiscal disequilibria in one state may create negative externalities for the other union member countries” (Berrittella and Zhang, 2015: 262). The monetary and fiscal policy setup in the SACU region raises the issue of how these two policies affect each other in meeting their objectives of stabilising the economy. Also, their response to economic conditions and the extent of their coordination have significant consequences for their effectiveness in the country’s economic performance (Reserve Bank of India, 2012).

Therefore, this study explores the extent of fiscal policy spillovers from South Africa to the BLNS countries as well as the interaction between monetary and fiscal policies in the SACU region. In their interactions, the monetary and fiscal policy authorities can either coordinate their policy actions or not. For this study, coordination of monetary and fiscal policies refers to the synchronised or harmonised interaction between the policies, which means that in the case of coordination, both policies move in the same direction, whereas non-coordination refers to a situation where the policies move in opposite directions (Kappel and Janku, 2014).

The Set-theoretic approach (STA) and policy reaction functions were used to measure the degree of policy coordination for the period between 1960 to 2017, depending on the availability of data. The STA results show weak policy coordination within each of the SACU countries and between South Africa and the BLNS countries. These findings point to the need for fiscal and monetary authorities to strengthen policy coordination towards enhanced macroeconomic stability (Oboh, 2017). South Africa, the dominant economy in the SACU region, also showed weak policy coordination. This weak policy coordination could be because of no prescribed arrangements to ensure good communication between authorities.

Suggested measures that can be taken by the SACU countries to promote greater policy coordination include the need to strengthen the relationship between the monetary and fiscal authorities as well as the need to ensure proper public debt management considering that high public debt levels can hamper coordination with monetary policy (Ramlogan and Sookram, 2018).

However, the policy reaction functions do provide some evidence of interactions between monetary and fiscal policy as indicated by the significant coefficients of the influence of one policy instrument on the other. The question of whether or not monetary policy adjusts to fiscal policy is addressed by the monetary policy reaction function results. The findings show that the monetary policies of Botswana, Lesotho and South Africa do not adjust to domestic or South African fiscal policies. In the Swaziland case, domestic fiscal policy conflicts with its own monetary policy. Monetary policy in Swaziland and in South Africa also reacts to other variables (i.e. domestic inflation and output gap), while Botswana and Lesotho monetary policies just follow South African monetary policy.

With regard to the fiscal policy reaction, the main question is whether or not fiscal policy adjusts to monetary policy. The findings show that Botswana adjusts to and coordinates with its own and South African monetary policies, while Lesotho only coordinates with South African monetary policy. In Botswana and Lesotho, fiscal policy does not adjust to their own debt. Furthermore, South African and Swaziland fiscal policies do not coordinate or conflict with domestic and South African monetary policies, but they adjust to their own debt levels.

Considering the Nash and Stackelberg outcomes, the findings imply monetary leadership for Botswana and Lesotho where monetary policy leads fiscal policy, while Swaziland and South Africa imply a Nash equilibrium, where the policy authorities do not take into account one another's reactions. Other findings are that monetary policies in Lesotho and Swaziland do not respond to changes in inflation. The insignificant effect is likely due to the participation of the Lesotho and Swaziland in the CMA where the countries maintain a fixed exchange rate with South Africa as well as the *de facto* dominance of the South African monetary policy in the region.

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## APPENDIX

### Stationarity tests (KPSS)

Variable	Country	KPSS Statistics		Conclusion
		<i>Level</i>	<i>1st difference</i>	
Policy rate	<b>B</b>	0.21		I (0)
	<b>L</b>	0.28		I (0)
	<b>N</b>	0.67	0.08	I (1)
	<b>S</b>	0.39		I (0)
	<b>SA</b>	0.33		I (0)
Government expenditure	<b>B</b>	0.16		I (0)
	<b>L</b>	0.68	0.29	I (1)
	<b>N</b>	0.37		I (0)
	<b>S</b>	0.08		I (0)
	<b>SA</b>	0.88	0.17	I (1)
Debt	<b>B</b>	0.68	0.07	I (1)
	<b>L</b>	0.35		I (0)
	<b>N</b>	0.30		I (0)
	<b>S</b>	0.16		I (0)
	<b>SA</b>	0.15		I (0)

**ARTICLE IV**  
**LINKAGES BETWEEN FINANCIAL DEVELOPMENT, ECONOMIC GROWTH AND  
FISCAL POLICY IN THE SACU AREA**

**1. INTRODUCTION**

The relationship between financial development and economic growth is an aspect of the financial market and economic integration, as well as policy coordination debate. Because it promotes economic growth and financial development, increased financial market integration across countries is one of the key features in the extent of economic and monetary integration among countries (Aziakpono, 2008). The findings from Article 1 show that there is increased financial integration among the SACU countries. Part of this increased financial integration can be attributed to the adoption of market-oriented economic and financial reforms such as capital account liberalisation, and the minimised regulation of domestic financial markets, which promote the development of a country's financial system (Agenor 2003). Thus, *a priori*, there is a positive relationship between financial integration and financial development. *A priori*, there is also a positive link between financial development and the effectiveness of the monetary policy. Monetary policy signals transmit better in a well-developed financial system. Also, the positive or negative economic growth effects can be amplified by economic integration, which makes firms, production factors and financial systems more accessible and developed across countries (Silberberger and Koniger, 2016).

**1.1. Relationship between financial development and economic growth**

Furthermore, a well-developed financial system has the potential and capacity to accelerate a country's economic growth (Pradhan, Arvin, Norman and Bahmani, 2019; Jedidia, Boujelb and Hela, 2014). Hassan, Sanchez and Yu (2011) highlight that economic growth also has the potential to boost financial development in an economy. Hence, the main focus of this study is exploring the relationship between financial development and economic growth and establishing how the two concepts relate across borders in the SACU countries. According to Loayza, Ouazad and Ranciere, (2017), financial development refers to the degree to which financial instruments, markets, and intermediaries enhance the effects of information, enforcement, and transactions costs by providing financial services to the economy.

These financial services may influence savings and investment decisions and hence economic growth. According to Noor and Rambeli (2017), causality can also run in the other direction, with economic growth boosting financial development through increased demand for financial systems.

The theoretical and empirical literature has expansively explored the relationship between financial development and economic growth. Several economists dating back to Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969) and Hicks (1969) to Seetanah, Ramessur and Rojid (2009) and Goswami (2013) note the relationship between financial development and economic growth. One of the theories exploring this relationship is endogenous growth theory, which stresses that the significance of financial development for long-run economic growth is through the efficient allocation of financial resources to productive use (Abu-Bader and Abu-Qarn, 2008; Loayza *et al.*, 2017). According to Aziakpono (2008: 15), the roles of the financial system in promoting economic growth include providing payments systems, mobilising savings, distributing capital and monitoring and applying corporate governance. Effective application and provision of these roles promote specialisation and innovation, efficient allocation of savings to economically viable projects, increased investment and productivity improvement (Aziakpono, 2008). These functions of the financial system above indicate that a well-organised financial system should promote economic growth.

However, as noted above, there is a possibility that economic growth leads to the development of a financial system. Early researchers such as Robinson (1952), Kuznets (1955), and Lucas (1988) argue that financial development is dependent on the expansion of the economy, which indicates that causality runs from economic growth to financial development. Noor and Rambeli, (2017) assert that the expansion of an economy could lead to an increased demand for financial services by households and firms where more financial institutions, products and services emerge, thus leading to the development of the financial systems. Another possibility is that there can be bi-directional causality between financial development and economic growth. This case was advocated by Berthelemy and Varroudakis (1996), who highlighted that there is mutual reinforcement between financial development and economic growth in what could either be a vicious or a virtuous cycle.

A vicious cycle refers to a scenario where financial system development and economic growth are inhibited by a low level of income, while a virtuous cycle is where a high-income level stimulates high financial system development, which in turn further boosts economic performance (Aziakpono, 2008). Moreover, there is a possibility of no causality between financial development and economic growth where financial development and economic growth do not affect each other.

## **1.2. Relationship between financial development, economic growth and policy**

A better understanding of the causal relationship between financial development and economic growth is relevant for policymakers because each of the possibilities of causality mentioned above has its corresponding policy implications. In a case of unidirectional causality running from financial development to economic growth, policymakers should explore policies that stimulate the development of the financial system to boost economic growth in the long run. Unidirectional causality running from economic growth to financial development implies that policymakers should focus on promoting economic growth to boost financial development. In the case of bidirectional causality, policymakers should consider policies that enhance both financial development and economic growth since these two concepts complement each other.

It is crucial to institute stable fiscal and monetary policies for financial reforms to succeed because the isolated implementation of these reforms is counterproductive (Hye and Islam, 2013). Therefore, monetary and fiscal policies can contribute to improving macroeconomic performance and influence the relationship between financial development and economic growth. The monetary policy can operate through the credit channel, one of the channels of the monetary transmission, and measure the effect through interest rate movements.<sup>37</sup> However, the effect requires a credit extension market with depth to operate. One way to measure that depth is the ratio of credit extended relative to GDP. The development of a financial system is critical for a country's economy, where the financial system aims to boost long-term economic growth through sufficient financing (Ginevicius *et al.*, 2019).

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<sup>37</sup> Interest rate focus of monetary policy was investigated in Articles 2 and 3

Monetary policy transmission channels create macroeconomic and financial linkages that enhance spillovers across economies (Bara and Le Roux, 2017).

Furthermore, fiscal policy, particularly public expenditure, is notably an essential element in the financial development and economic growth nexus because it is one of the critical determinants and a significant factor for economic growth (Adedeji, Ajayi, and Tizhe, 2019). Therefore, fiscal policy activities can play an important role in boosting macroeconomic stability and creating the necessary pre-conditions for finance to thrive (Bittencourt, 2012). Public expenditure can affect the relationship between financial development and economic growth in two ways. Firstly, is the relationship between public expenditure and economic growth that has two opposing hypotheses dealing with the direction of causality in the relationship: Wagner's law and the Keynesian hypothesis. Wagner's law proposes that there is a long-run positive relationship between public expenditure and economic growth, with causality running from economic activity to government expenditure. As the economy expands, so does the demand for the public services provided by the government. Also, the rate at which the demand for public services expand exceeds the rate of economic growth, which implies a steadily rising share of government expenditure in GDP. The Keynesian view highlights that causality of the nexus runs from public expenditure to economic growth. According to Adedeji *et al.*, (2019), the Keynesian view highlights that the size and structure of public expenditure determine the economic performance of a country through providing growth-led facilities, particularly economic and social infrastructure.

Second, fiscal policy activity is central to the development of the financial sector. The two views associated with that are the development view and the political view (Demetriades and Rousseau, 2010; Cooray, 2011). The development view states that the government, through lower financial costs and increased financial access, can help promote the development of an economy by overcoming market failures, i.e. an increase in government spending leads to an increase in the credit extended in the economy (financial development). The political view, on the other hand, contends that higher government involvement can lead to inefficiency through increasing interest margins and overhead costs. This effect is more pronounced when the government pursues political objectives in an economy with weak property rights (Cooray, 2011). Thus, higher government expenditure leads to lower financial development.



Public expenditure in developing countries, such as the SACU countries, has been increasing over the years resulting mainly from increased spending on administrative procurement, debt service, high national security outlay and infrastructural expansion and other capital development. Rising public expenditure has implications for macroeconomic stability and performance of an economy, which includes the financial development and economic growth nexus (Rafindadi and Aliyu, 2017). Such an implication raises the question of how fiscal policy (i.e., public expenditure) relates to the financial development and economic growth nexus in the SACU region.

### **1.3. Relationship between financial development, economic growth and financial development spillovers**

As shown in the first three articles of this thesis, in the SACU region, South Africa has strong ties, is dominant, and has significant spillover effects of her monetary and fiscal policies to the other SACU countries. Canales-Kriljenko, Gwenhamo, and Thomas (2013) highlight that there are various South African financial institutions such as banks, insurance companies, and investment managers spread across the region and some of the big South Africa banks have significant ownership and control in the smaller SACU countries. Therefore, considering the South African dominance of the financial system in the region, there is a strong possibility that South African financial development spills on to the other SACU countries' economic growth or financial sectors (Bara and Le Roux, 2017, Yildirim, Ocal and Erdogan, 2008). According to Bara and Le Roux (2017) and Shinagawa (2014), financial development can spill over via bilateral portfolio investment, bilateral trade, home bias, and country concentration.

Therefore, this article extends the spillover analysis by examining if there are any significant spillover effects of South African financial development to the levels of financial development in the other SACU countries. Findings of this article will provide additional insight into the nature and magnitude of financial development spillovers within and across SACU countries as well as the potential efficacy of the monetary policy transmission channels across SACU borders. As a result, the main objective of this article is to explore the role of domestic and South African fiscal policy and South African financial development in the relationship between financial development and economic growth in the SACU countries. The main objective is addressed through the following secondary objectives:

- i. To establish the existence, nature of the relationship, and direction of causality between financial development (FD) and economic growth (EG) in the SACU countries, i.e.,  $FD_{SACU} \leftrightarrow EG_{SACU}$ .
- ii. To investigate the effect of fiscal policy in the finance-growth nexus in the SACU countries, i.e.  $Fiscal\ policy_{SACU} \rightarrow \{FD_{SACU} \leftrightarrow EG_{SACU}\}$ .
- iii. To establish whether or not there are South African government expenditure spillover effects on the relationship between financial development and economic growth of the other SACU countries, i.e.  $Fiscal\ policy_{SA} \rightarrow \{FD_{BLNS} \leftrightarrow EG_{BLNS}\}$ .
- iv. To establish whether or not there are South African financial development spillover effects on the relationship between financial development and economic growth of the other SACU countries taking into account the BLNS country's fiscal policy, i.e.  $FD_{SA} \rightarrow \{FD_{BLNS} \leftrightarrow EG_{BLNS}\}$ .

Most literature separately models financial development and government expenditure with economic growth. However, this article models financial development and government expenditure with economic growth. Modelling the three variables in a cointegration and vector-error correction framework may generate new information that could be used by the policymakers in the SACU countries. Therefore, this present study contributes to knowledge by assessing how government expenditure, financial development and economic growth are related to each other. It extends the assessment period from a study done by Aziakpono (2008). Also, understanding the nature of the relationship between financial development, economic growth and government expenditure will help to ensure that governments implement adequate policies for financial system development, economic growth or public expenditure. Another contribution of this article is the incorporation of the South African financial development spillover effects into the models of the other four SACU countries' models of financial development and economic growth.

## **2. LITERATURE REVIEW**

There is widespread recognition of the importance of the relationship between financial development and economic growth in the literature (for example, Bhattarai, 2015; Peia and Roszbach, 2015; Samargandi, Firdmuc and Ghosh, 2015).

This relationship between financial development and economic growth has been extensively debated among researchers, both in theoretical and empirical studies. However, these debates have led to inconclusive findings regarding the nature and direction of causality between financial development and economic growth. In an attempt to add clarity to the inconclusive literature, this thesis focuses on the relationship in an environment with domestic and international fiscal policy and financial development spillovers. Some of the pioneers of the subject of the relationship between financial development and economic growth are Schumpeter (1912), Goldsmith (1969), McKinnon (1973) and Shaw (1973). Later on, theoretical and empirical research added to the understanding and debate around the link between financial development and economic growth by exploring the existence, the causality direction as well as the channels of transmission of this relationship.

## **2.1. Relationship between financial development and economic growth hypotheses**

Theoretical and empirical research identifies mainly four prominent hypotheses that explain the association between financial development and economic growth: the supply-leading hypothesis, the demand-following hypothesis, feedback hypothesis and independent hypothesis. The first two hypotheses are among the early postulates developed in the literature examining the relationship between financial development and economic growth. Firstly, the supply-leading hypothesis also referred to as the 'finance-led growth hypothesis', states that financial development leads to higher economic growth (Patrick, 1966; Puente-Ajovin and Sanso-Navarro, 2015; Kolapo and Adaramola, 2012). The financial sector may affect economic growth by increasing the rate of physical and human capital accumulation, the size of savings and improving the efficiency of investment (Al-Yousif, 2002; Bist, 2018).

Several researchers found empirical support for the supply-leading view<sup>38</sup>. Briefly, these studies listed above investigated the relationship between financial development and economic growth for several Middle Eastern and Asian countries (for example,

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<sup>38</sup> include Shittu (2012), Hsueh, Hu, and Tu (2013), Uddin, Sjo, and Shahbaz (2013), Balago (2014), Herwartz and Walle (2014), Madichie, Maduka, Oguanobi, and Ekesiobi (2014), Gokmenoglu, Amin, and Taspinar (2015), Pradhan, Arvin, Hall, and Bahmani (2014), Komal, and Abbas, (2015), Samargandi *et al.* (2015), Simion, Stanciu and Armasele (2015), Saqib (2016), Ginevicius *et al.* (2019), and Pradhan *et al.* (2019)

Hsueh *et al.*, 2013; Gokmenoglu *et al.*, 2015; Saqib, 2016; Pradhan *et al.*, 2014; Samargandi, Firdmuc and Ghosh, 2014); European countries (for example, Simion *et al.*, 2015; Ginevicius *et al.*, 2019) and G-20 countries (Pradhan *et al.*, 2019).

Secondly, the demand-following hypothesis, also known as the 'growth-led finance hypothesis', was advanced by Robinson (1952), and it states that economic growth has a positive effect on financial development. This hypothesis implies that the expansion of the real economy leads to an increased demand for, and then the growth of, financial services. Examples of researchers who found empirical support for the demand-following hypothesis include Christopoulos and Tsionas (2004), Odeniran and Udejaja (2010), Odhiambo (2011), Hassan *et al.* (2011) and Menyah, Nazlioglu and Wolde-Rufael (2014). In investigating the relationship between financial development and economic growth, Christopoulos and Tsionas (2004) focused on ten developing countries, namely Colombia, Paraguay, Peru, Mexico, Ecuador, Honduras, Kenya, Thailand, Dominican Republic, and Jamaica, while Odeniran and Udejaja (2010) focused on Nigeria. Odhiambo (2011) tested the relationship for South Africa, Hassan *et al.* (2011) for a panel of low- and middle-income countries, and Menyah *et al.* (2014) for twenty-one African countries.

Thirdly, the feedback hypothesis, also known as a bi-directional hypothesis, asserts that financial development and economic growth affect each other. "The real sector may provide the financial system with the funds necessary to enable financial development, eventually allowing for a capitalisation on financial economies of scale, which, in turn, facilitates economic development" (Madichie *et al.*, 2014: 200). Empirical literature that found support for the bi-directional causality includes Al-Malkawi, Marashdeh and Abdullah (2012), Akinlo and Egbetunde (2010), Marques, L. M., Fuinhas and Marques, A. C. (2013), Hassan *et al.* (2011), Jedidia *et al.* (2014), and Pradhan, Arvin, Bahmani, Hall and Norman (2017). Al-Malkawi *et al.* (2012) examined the finance-growth nexus for the United Arab Emirates, Akinlo and Egbetunde (2010) for Sub-Saharan African countries, Marques *et al.* (2013) for Portugal, Hassan *et al.* (2011) for a panel of low- and middle-income countries, Jedidia *et al.* (2014) for Tunisia and Pradhan *et al.* (2017) for ASEAN Regional Forum countries.

Lastly, the independent hypothesis refers to no relationship between financial development and economic growth. Lucas (1988) proposed this notion highlighting that “economists badly overstress the role of financial factors in economic growth”. Examples of researchers who found support for the independent hypothesis include Stern (1989), Kar, Nazlioglu and Agir (2011), Menyah *et al.* (2014). Kar *et al.* (2011) investigated the direction of causality between financial development and economic growth for the Middle East and North African (MENA) countries, and Menyah *et al.* (2014) for 21 African countries.

However, Ginevicius *et al.* (2019) discuss a fifth possible hypothesis, which is the negative relationship between financial development and economic growth. The negative relationship could be due to poor financial regulation and allocation of credit which result in the poor selection of growth-enhancing projects. Also, cases of excessive credit growth give rise to high economic volatility and a high probability of a financial crisis, which could hamper the proper allocation of credit and economic performance (Ayadi, Arbak, Ben-Naceur and De Groen, 2013; Arcand, Berkes and Panizza, 2015). In examining this relationship Ayadi, *et al.* (2013) found a negative relationship for Mediterranean countries, Herwartz and Walle (2014) for 73 low- and middle-income countries, Cecchetti and Kharroubi (2015) for ten advanced OECD countries, Adeniyi, Oyinlola, Omisakin and Egwaikhide, (2015) for Nigeria and Seven and Yetkiner (2016) for a panel of low-, middle- and high-income countries.

## **2.2. Empirical literature**

Various empirical studies examining the relationship between financial development and economic growth follow two main research directions. On the one hand, some researchers specifically test whether or not financial development affects economic growth, regardless of whether a reverse causal impact exists or not. These studies<sup>39</sup>, generally, neither test the existence nor estimate the strength of a possible reverse causality from economic growth to financial development.

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<sup>39</sup> Examples include King and Levine (1993), Levine, Loayza and Beck., (2000), Ibrahim and Alagidede (2018), Nieh, Chang, Russel and Hung (2009), Shittu (2012), Odhiambo (2011), Odeniran and Udejaja (2010), Adu, Marbuah and Mensah (2013), Jedidia *et al.* (2014), Madichie *et al.* (2014), Saqib (2016), Seven and Yetkiner (2016), Ibrahim and Alagidede (2017), Asteriou and Spanos (2019) and Ehigiamusoe, Lean and Lee (2019).

On the other hand, other researchers explicitly examine both directions of causality between financial development and economic growth. This group of studies<sup>40</sup> often use cointegration and Granger causality tests to determine the long-run relationship and the direction of causality between financial development and economic growth. The discussion above shows that the majority of financial development and economic growth studies found unidirectional causality running from financial development to economic growth, i.e., supply-leading hypothesis.

Within this branch of finance-growth nexus literature, a sub-set of studies have explored the relationship between financial development and economic growth either by controlling for other macroeconomic variables or under certain conditions such as during the financial crises periods, or at different threshold levels of financial development and real GDP. Asteriou and Spanos (2019) and Breitenlechner, Gachter and Sindermann (2015) examine the relationship in the face of the global financial crisis to establish how the crisis period affected the finance-growth nexus. They find that financial development promoted economic growth before the crisis, while after the crisis, it hindered economic growth for the European countries.

Regarding thresholds, Seven and Yetkiner (2016), Adeniyi *et al.*, (2015), Cecchetti and Kharroubi (2015), Beck, Georgiadis, and Straub (2014) and Samargandi *et al.* (2014) are some of the researchers who examined the relationship between financial development and economic growth. Their research shows that there is a nonlinear relationship between the two variables where the relationship differs below and above a threshold value of financial development and economic growth. Furthermore, there are several macroeconomic variables suggested in the literature that affect financial development and economic growth nexus. These include the monetary policy related variables (inflation, real interest rate, money supply, and lending rate), trade related variables (trade openness, foreign direct investment, financial openness, and exchange rate), as well as fiscal policy related variables (government expenditure, government institutional quality, public governance).

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<sup>40</sup> Examples of these studies include Khan, Qayyum, Skeikh and Siddique (2005), Zang and Kim (2007), Liang and Teng (2006), Ang and McKibbin (2007), Halicioglu (2007), Bhattacharya and Sivasubramanian (2003), Akinlo and Egbetunde (2010), Hye and Dolgoplova (2011), Gokmenoglu *et al.*, (2015), Simion, Stanciu and Armaselu (2015), Rateiwa and Aziakpono, (2016), Ginevicius *et al.* (2019) and, Pradhan *et al.* (2019).

For monetary related variables, researchers<sup>41</sup> include foreign direct investment (FDI) and trade openness as additional variables. Moreover, Ehigiamusoe *et al.* (2019) include the real exchange rate and its volatility. Examples of studies that control for government expenditure include Abu-Bader and Abu-Qarn (2008); Aziakpono (2008), Demetriades and Rousseau (2010), Al-Malkawi *et al.* (2012), Pradhan *et al.* (2014), Rafindadi and Aliyi (2017) and Ehigiamusoe *et al.* (2019). The main finding across these studies is that inflation, government expenditure, trade openness and real exchange rates are significant variables affecting the relationship between financial development and economic growth.

However, with its focus on financial development and spillover, as well as fiscal policy, to preserve degrees of freedom, this study only controls for fiscal policy. The degrees of freedom are limited because fiscal variables are only available on an annual basis. Having data on an annual basis poses a challenge in the model estimation, as the small number of observations effectively limits the number of variables that can be included. This study focuses on establishing the role of government in the relationship between financial development and economic growth. The government has an important role to play in the economy, which includes providing public goods and services and financial services through regulation of some of the private sector activities. This role indicates the potential link that the government has with economic growth and financial development, hence the primary focus of this study is to ascertain how fiscal policy affects the financial development and economic growth nexus. Several researchers investigate the role of government in financial development.<sup>42</sup>

### **2.2.1. Fiscal policy and financial development**

As highlighted in the introduction above, the development and political views are the main views in the literature that can explain the role of government in the development of financial institutions.

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<sup>41</sup> Pradhan *et al.* (2019) and Asteriou and Spanos (2019) include inflation. Asteriou and Spanos (2019), Shahbaz, Bhattacharya and Mahalik (2015), Gokmenoglu *et al.* (2015), Menyah *et al.* (2014), and Pradhan *et al.* (2014)

<sup>42</sup> These include Aluko and Ibrahim (2019), Nwaogwugwu (2018), Naceur, Cheirf and Kandil (2014), Takyi and Obeng (2013), Cooray (2011), Demetriades and Rousseau (2010), and Hauner (2009).

These views assert that the government can either promote or hamper financial development (Aluko and Ibrahim, 2019). The development view advocates that increased public expenditure promotes the development of financial institutions through improved market access and reduced market failures. Evidence of a positive effect of public expenditure on financial development demonstrates that fiscal policy improves the development of financial systems. According to Cooray (2011) and Naceur, Cheirf and Kandil (2014), the political view posits that government involvement in the financial sector can hamper financial development by stifling the efficient operations of the financial institutions through lower competition. Aluko and Ibrahim (2019) refer to another view, the classical view, which emphasises that private investment is crowded out by higher public spending, which resultantly hinders the development of the financial system. This translates into a negative effect of government on financial sector development. Cooray (2011) and Naceur *et al.* (2014) concur that a negative impact of government activity could arise in a situation where government increases its market power. This is associated with increased rent-seeking and the crowding out of the private investment that inhibits the development of the financial system.

Furthermore, the negative effect could stem from various sources such as direct and indirect taxation of banks, as well as money from selling their bonds. According to Badun (2013), considering that some of the government expenditure is financed by tax from banks, as these taxes increase banks raise their lending interest rates or other bank fees to shift most of the tax burden to their clients. Also, as governments compel banks to buy bonds to finance its own public spending, the costs of financial intermediation increase as banks charge higher interest rates to private sector clients to compensate for lower interest rates on government loans (Badun, 2013).

Researchers such as Filippidis and Katrakilidis (2014) found evidence of a positive role played by the government in financial development in a cross-section of 39 low- and lower-middle-income countries. However, several researchers found evidence of a negative impact of government on financial development. These include Cooray (2011) for a sample of 71 countries, Ekpeyong and Udoh (2017) for Nigeria, Joshi and Giri (2015) for India, Adeniyi *et al.* (2015) for Nigeria, Naceur *et al.* (2014) for Mediterranean countries, Mahawiya (2015) and Ahmed (2013) for Sub-Saharan



countries as well as Demetriades and Rousseau (2010) for high-income countries. In contrast, studies by Takyi and Obeng (2013) and Demetriades and Rousseau (2010) find an ineffective government role in financial development for Ghana and low-income countries, respectively. These findings imply that government spending does not have a significant effect on private credit, nor does it crowd out private sector credit.

### **2.2.2. Government expenditure and economic growth**

Several studies have examined the relationship between government expenditure and economic growth. These include Adedeji *et al.*, (2019), Pula and Elshani (2018) for Kosovo, Rosoiu (2015) for Romania, Bayrakdara, Demez and Yapar (2015), Salih (2012), Menyah *et al.* (2014), Butkiewicz and Yanikkaya (2011) for developed and developing nations, Wu, Tang and Lin (2010) for a panel of 182 countries, Tang (2001) for Malaysia, Al-Faris (2002), Dogan and Tang (2006). These studies either focused on determining the direction of causality between the two concepts while assuming a positive relationship or have focused on establishing the effect of government spending on economic growth. The direction of causality mainly tests whether or not there is support for Wagner's law or the Keynesian hypothesis.

Wagner's law views government expenditure as an endogenous factor, which depends on economic growth. This means that government expenditure plays no role in economic growth and cannot be relied upon as a policy instrument (Tang, 2001). Instead, fiscal authorities tend to increase the level of public spending as the level of output is expanding. According to Tang (2001: 38), "...the rationale behind the Wagner's law is that firstly, industrialisation gives rise to an increased scale of government activities, which arise from the administrative and protective functions of the state; secondly, is to ensure the proper operation of market forces, and finally is the provision of social and cultural goods." Moreover, the Keynesian hypothesis views government expenditure as an exogenous factor, which influences economic growth. This means that government expenditure can be used as a policy variable that fiscal authorities can use to influence economic activity.

According to the Keynesian view, government expenditure has a positive impact on economic growth, as it improves the level of productive investment. Tang (2001), Adamu and Hajara (2015), Facchini and Melki (2013), Gachunga (2019), Jalles (2019), Kumar, Webber and Fargher (2012), Magazzino, Giolli, and Mele (2015), Obeng and Sakyi (2017) and Sagdic, Sasmaz, and Tuncer (2019) found support for Wagner's law. In contrast, Dudzevičiūtė, Šimelytė, and Liučvaitienė (2018), Oladele, Mah and Mongale (2017) found support for Keynesian hypotheses.

Nevertheless, literature also provides a view that government expenditure can negatively affect economic growth. Increased public spending has the potential to impede economic growth by crowding out private sector spending, particularly if the spending is funded through borrowing (Amusa and Oyinlola, 2019; Stratmann and Okolski, 2010). Most studies that find a negative effect of government expenditure on economic growth attribute the negative effect to the composition of public spending, with situations where government expenditure dominated by recurrent expenditure hampers the growth of an economy. Wu *et al.* (2010) confirm that government spending could have a negative effect if it mostly involves government consumption expenditure.

Examples of studies that found a negative effect of government spending on economic growth include Adu and Ackah (2015) for Ghana; Carter, Craigwell and Lowe (2013) for Barbados; Ogundipe and Oluwatobi (2013) for Nigeria; Attari and Javed, (2013) for Pakistan; Butkiewicz and Yanikkaya (2011) for developed and developing nations; Nurudeen and Usman (2010) for Nigeria and Nketia-Amphonsah (2009) for Ghana. Moreover, Bagdigen and Cetintas (2004) for Turkey, Durevall and Henrekson (2011) for Sweden and the UK, and Pelawaththage (2019) for Sri Lanka are also studies that found a negative association between economic growth and public expenditure. This means that overall growth and development is not always accompanied by an expansion in the size of government expenditure.

This article follows Aziakpono (2008) who examined, using the weak exogeneity tests, the direction of causality among financial development, economic growth and government expenditure for each of the SACU countries. This involved testing which of the variables are endogenous.

Aziakpono (2008) found that economic growth was endogenous for all SACU countries, and financial development was exogenous for all countries except Lesotho. Government expenditure was endogenous only for Botswana and South Africa and was insignificant for the Lesotho and Swaziland. Aziakpono (2008) mainly focused on testing the relationship between financial development and economic growth with the inclusion of a third (macroeconomic) variable as a control variable<sup>43</sup>, which made it a trivariate model.

However, the current study differs slightly from the Aziakpono (2008) study in that it models the financial development and economic growth nexus with government expenditure as a control variable. Also, the current model accounts for cross border spillover effects from South African fiscal policy and financial development to the smaller SACU countries by including these South African variables in the country models. There is a possibility of modelling the fiscal policy variable as a function of economic growth and financial development if it is found to be endogenous in the weak exogeneity tests. This means that apart from investigating the relationship between financial development and economic growth, the article also presents findings on the relationship between government expenditure, on the one hand, and economic growth and financial development on the other.

The literature discussion above indicates that there is no consensus on the relationship between financial development, economic growth and government expenditure. Thus, this lack of consensus on the nature and the direction of the relationship between these variables provide weight to the significance of this study. Another perspective of this article is the effect of foreign spillovers on the relationship between financial development and economic growth. A study by Bara and Le Roux (2017) is similar to the focus of this article as it seeks to establish the nature and magnitude of financial spillovers from South Africa to other Southern African Development Community (SADC) countries. In other words, Bara and Le Roux (2017) assess the effect of South African financial development shocks on economic growth and financial development of other SADC economies using Bayesian VAR analysis.

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<sup>43</sup> Additional macro variables used as control variables by Aziakpono (2008) are investment, inflation, interest rate spread, trade openness and government expenditure to GDP ratio.

The authors find evidence of significant direct and positive spillover effects from the SA financial sector to the financial sectors of the other SADC countries.

Other spillover studies include Abid, Bahloul and Mroua (2016) who investigate the extent of shock transmission from a dominant financial sector of one country to other the Middle East and North Africa (MENA) countries. The authors find evidence of weak spillover effects across stock markets. Most of the literature on financial spillovers has mostly been in stock and financial markets. Examples include Fic (2013) who investigate quantitative easing spillovers from the US to developing and developed economies, Ivan (2012) who examine spillovers across Latin America's stock markets, Beaton and Desroches (2011) who analyse the US financial spillovers to Canada, and Ciccarelli, Ortega, and Valderrama (2012) who investigate the presence of spillovers in macro-financial linkages across developed economies. These studies all find significant financial spillovers across countries. However, these studies differ from the current study, in that the financial spillovers considered in this article are those of bank credit and not of stock market activity, mainly due to data limitation in the smaller SACU countries. Also, the spillover literature above shows that there is limited research on the spillovers of financial development across countries, hence the focus of this article.

### **3. METHOD**

The main objective of the article is to determine how financial development, economic growth and government expenditure are linked in the SACU countries. The method of analysis used in this article is the vector error correction modelling (VECM) framework. Granger causality and the cointegration approach have been used to test the relationships between financial development, economic growth and government expenditure (for example, Gokmenoglu *et al.*, 2015, Pradhan *et al.*, 2014 and Ehigiamusoe *et al.*, 2019). For a significant relationship between financial development, economic growth and government expenditure to hold in the presence of non-stationary data generating processes, there must be a cointegrating relation between the variables. The weak exogeneity tests in the cointegrating framework then determine the direction of causality of the variables in question.

In this article, the relationship between financial development, economic growth, and government expenditure will be tested using the Johansen cointegration approach, which is a maximum likelihood procedure proposed by Johansen (1988). From the literature discussed above, the test for relationship involves testing cointegration on financial development, economic growth and government expenditure, as well as incorporating spillovers from South African financial development and government expenditure. These spillovers will be incorporated into one model, which means that the model with spillovers will have five variables, where 3 are domestic variables, and 2 are South African variable to account for spillover effects. Therefore, due to the small sample size, and to preserve the low degrees of freedom, a maximum of five variables are included.

The Johansen procedure is used to establish the presence of cointegrating relationships in a system of variables. This analysis will be in a country-specific framework involving variables of a specific country and South African variables to measure spillovers. Since the standard Johansen procedure requires that the variables in the system be integrated of order one,<sup>44</sup> i.e.  $I(1)$ , the first step would be unit root testing to establish the order of integration of the country variables. The article uses the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) stationarity test because, compared to other traditional unit root tests (augmented Dickey-Fuller, Phillips-Peron and DF-GLS tests), it has more statistical power. If all the series are non-stationary, thus  $I(1)$ , the next step is to test for cointegration. The test for cointegration involves estimation of an unrestricted vector autoregression model (VAR) to establish the appropriate lag length using several information criteria statistics. The information criteria statistics employed are the sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ).

The Johansen cointegration test is then used to establish whether or not a long-run relationship exists among the variables at the chosen lag length. If a relationship exists, a vector error correction model (VECM) is specified.

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<sup>44</sup> Note that the Johansen procedure can also be run with  $I(2)$  variables, but this is not considered for this study. The procedure also does not preclude the inclusion of  $I(0)$  variables, as long as the number of  $I(1)$  variables included exceeds the number of cointegrated relationships among the variables.

The Johansen procedure uses the Trace and the maximum eigenvalue tests to establish the number of cointegrating vectors (usually denoted  $r$ ). In the presence of cointegration, a VECM is specified, and the parameters of interest estimated. A VECM is a restricted VAR designed for use with non-stationary series that are known to be cointegrated, which implies that a VECM specification only applies to cointegrated series. The VECM estimates parameters of the cointegrating vector(s) that are given economic meaning by normalising on the endogenous variables in the model. The VECM also looks into the short-term dynamics of the variables in the system through the estimation of the error correction term. The error correction term implies that the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The VEC representation to be estimated is given by equation (1) as specified in Johansen and Juselius (1990):

$$\Delta X_{it} = \Pi X_{it-1} + \Sigma \Gamma_k \Delta X_{it-k} + \varepsilon_t \quad (1)$$

where  $X_{it}$  represents an  $m \times 1$  vector consisting of the  $I(1)$  country variables,  $\Gamma_k$  represents short-run coefficients,  $\varepsilon_t$  represents the stochastic error terms and  $k$  is the lag length selected.  $\Pi$  represents a coefficient matrix,  $\alpha\beta'$ . The elements of the  $\alpha$  matrix are the adjustment coefficients, i.e. error correction terms, which describe the speed of adjustments to the long-run equilibrium following a short-run shock (Cerrato, Kim and MacDonald, 2013). The elements of the  $\beta$  matrix are the long-run coefficients.

The Johansen technique also involves the use of the weak exogeneity test. The weak exogeneity test establishes which of the three variables (financial development, economic growth and government expenditure) are weakly exogenous. To perform the weak exogeneity test, restrictions are imposed on the adjustment coefficients (i.e. elements of the  $\alpha$  matrix). The presence of cointegration implies that causality must at least run from one variable to another. Thus, this current study uses a weak exogeneity test in a VECM framework to establish the direction of causality among financial development, economic growth and government expenditure.

Once cointegration and causality are established and confirmed, the next step involves estimating the long-run and error correction coefficients of the cointegration equation. From the VECM results, standardised long-run coefficients are calculated as follows:

$$\beta \times \frac{s_x}{s_y}$$

Where  $\beta$  is the long-run unstandardized coefficient,  $s_x$  is the standard deviation of the respective independent variable,  $x_i$  and  $s_y$  is the standard deviation of the respective dependent variable,  $y_i$ . The standardised coefficients are calculated to compare the magnitudes of the effects of each individual independent variable (namely financial development, economic growth or fiscal policy) on the dependent variable (the variable on which the relationship is normalised). The estimation of the error correction terms gives rise to a question of how long it takes for the economy to adjust back to its equilibrium after a shock or a disturbance.

The VECM then goes through residuals diagnostic checking for serial correlation and heteroscedasticity. For a good quality model, null hypotheses of the serial correlation and heteroscedasticity tests should not be rejected. The non-rejection of these residual tests is vital for the analysis; otherwise, the hypothesis tests of estimated parameters will be invalid. Moreover, for a good quality model, the adjusted R-squared is used to establish the explanatory power of the model. Following Aziakpono (2008), an arbitrary 30% is used as a benchmark for assessing the explanatory power. This means that a good quality model should have an adjusted R-squared value of at least 30 percent.

#### **4. DATA AND RESULTS**

The data used in this chapter is measured annually and ranges from 1972 to 2017, which makes a sample size of 46. Following Juselius and Toro (2005), who highlight that caution must be exercised when interpreting “long-run” relationships inferred from cointegration properties of small sample sizes, the concept of a “long-run relation” in this article also refers to a cointegrating relation between the variables being considered. The proxy used for financial development in this study is the ratio of credit extended to the private sector by commercial banks to nominal GDP. A high value indicates a high dependence on banks for credit, which implies higher development of the system. This measure of financial development “accounts for credit advanced to the private sector that propels the utilisation and allocation of funds to more efficient and productive activities” (Ibrahim and Alagidede, 2017: 69).

Private sector credit is the most common measure of financial development used in literature (Ibrahim and Alagidede, 2017). Examples of studies using bank credit to the private sector as a measure of financial development include Ncanywa and Mabusela (2019), Breitenlechner *et al.* (2015), Bittencourt (2012), Arcand *et al.* (2015), Hassan *et al.* (2011), Jalil, Feridun, and Ma (2010), Odeniran and Udejaja (2010). Private sector credit from banks is the relevant measure of financial development available for the SACU countries because banks in the smaller SACU countries make up most of the financial development in those countries.

A potential weakness of this financial development measure is that it does not capture financial development taking place outside banks. However, Rother (2001) and Aziakpono (2008) argue that the exclusion of financial development outside banks is unlikely to affect results because financial institutions in most developing countries (including the SACU countries, except for South Africa) are underdeveloped. Other financial development measures identified in the literature include interest rates, monetary aggregates (M1, M2, and M3), gross domestic savings-to-GDP, and total bank assets. However, these could not be used in this study because of data limitations and inconsistencies for the BLNS countries. Moreover, these measures mostly demonstrate the extent of transaction services offered by the financial sector compared with the sector's ability to allocate deposited funds to investors (Seven and Yetkiner, 2016; Ibrahim and Alagidede, 2017). Economic growth is measured by gross domestic product per capita (for example, Odeniran and Udejaja, 2010; Aziakpono, 2008; Jalil *et al.*, 2010), and government expenditure is measured by general government expenditure as a percentage of GDP. The sources of the data are the IMF IFS and World Bank databases.

Before doing any analysis, stationarity tests are done to determine the order of integration of the variables used in the analysis, and the results are presented in Table 1. Financial development for Lesotho and Swaziland and government expenditure for Swaziland are stationary. All other variables are integrated of order one.<sup>45</sup>

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<sup>45</sup> "Even though some of the variables are level stationary, they are included in the models since theory suggests that they are important variables in explaining both output level and financial development. As Harris (1995: 80) notes, the inclusion of I (0) variables may play "a key role in establishing a sensible long-run relationship between non-stationary variables if theory *a priori* suggests that such variables should be included."



Following the results of the unit root tests, cointegration analysis was done to establish whether or not there is a cointegrating relationship between the variables. However, the unit root results mean that the Lesotho and Swaziland VECMs cannot normalise on financial development.

Table 1: Stationarity tests

Variable	Country	KPSS Statistics		Conclusion
		Level	1st difference	
Financial development (FD)	B	0.569	0.196	I (1)
	L	0.088	-	I (0)
	S	0.146	-	I (0)
	SA	0.679	0.090	I (1)
GDP per capita (Y_PC)	B	0.628	0.175	I (1)
	L	0.743	0.273	I (1)
	S	0.844	0.221	I (1)
	SA	0.475	0.282	I (1)
Government expenditure (GE)	B	0.512	0.124	I (1)
	L	0.603	0.188	I (1)
	S	0.107	-	I (0)
	SA	0.613	0.166	I (1)

Note: The critical values of the KPSS test are 0.347 for 10%; 0.463 for 5% and 0.739 for 1%.

Cointegration analysis is performed on a model comprising domestic financial development, economic growth, and government expenditure, as well as South African financial development and government expenditure, i.e., VAR = {Y\_PC; FD; GE; FD<sub>SA</sub>; GE<sub>SA</sub>). This model captures the dynamics of the finance-growth relationship in the domestic environment and the spillover effects from South African financial development and government expenditure. The South African model is estimated with only the domestic South African variables. No BLS variables are included in the South African model because Articles 1 to 3 have shown that South Africa is dominant in the region and its actions affect the policymaking actions in the smaller SACU countries, but not vice versa.

Table 2 displays the Johansen cointegration results for the two models. The table reports the applicable deterministic trend assumptions of whether intercept and trends are included in the long-run or short-run relationship, the Trace statistic, maximum eigenvalue statistic and the p-values. The trace and maximum eigenvalue statistics indicate one cointegrating equation among financial development, economic growth and government expenditure variables for each of the SACU countries at a 5% significance level.

Once cointegration is established, further investigation is done using weak exogeneity tests to establish the direction of causality among the variables in the models. Table 3 presents the weak exogeneity results, which report the Chi-squared statistic and its p-value. The results indicate that South Africa and Swaziland have two endogenous variables, economic growth and financial development for their respective countries, Botswana also has two endogenous variables, financial development and government expenditure, while Lesotho only has economic growth as endogenous.

Table 2: Johansen cointegration test results

Model 1: VAR = {Y_PC, FD, GE}							
Ctry	A	Trace statistics under $H_0: \text{rank} = r$			Max eigenvalue stats under $H_0: \text{rank} = r$		
		r=0	r≤1	r≤2	r=0	r=1	r=2
SA	1	42.686 (0.007)	16.651 (0.146)	4.408 (0.355)	26.035 (0.014)	12.243 (0.172)	4.408 (0.355)
Model 2: VAR = {Y_PC, FD, GE, FD <sub>SA</sub> , GE <sub>SA</sub> }							
Ctry	A	Trace stats under $H_0: \text{rank} = r$			Max eigenvalue stats under $H_0: \text{rank} = r$		
		r=0	r≤1	r≤2	r=0	r=1	r=2
B	3	72.916 (0.028)	44.415 (0.102)	24.791 (0.169)	28.501 (0.191)	19.623 (0.368)	17.338 (0.157)
L	2	98.925 (0.000)	30.922 (0.113)	15.196 (0.358)	38.003 (0.020)	22.496 (0.247)	18.594 (0.152)
S	2	79.231 (0.033)	43.461 (0.310)	25.994 (0.342)	35.770 (0.038)	17.466 (0.621)	16.293 (0.278)

Note:

1. All countries have an optimal lag of 2 for the specified VAR, which produces white noise residuals;
2. Values in (.) denote p-values;
3. To decide on whether there is cointegration or not, a 5% significance level is used in this article;
4. A is the deterministic trend assumption of the cointegration test, where 1 assumes no intercept or trend in the cointegrating equation or test VAR; 2 includes intercept and no trend in the cointegrating equation and no intercept in VAR; 3. Assumes inclusion of intercept (no trend) in cointegrating and VAR equations, and 4 means both the level data X and the cointegrating equations have linear trends.

Table 3: Weak exogeneity test results

Model 1: VAR = {Y_PC, FD, GE}										
Country	Weak exogeneity test					Long-run Causality Result				
	Y_PC	FD	GE			Y_PC	FD	GE		
SA	4.864 (0.027)	8.705 (0.003)	1.740 (0.187)			N	N	Y		
Model 2: VAR = {Y_PC, FD, GE, FD <sub>SA</sub> , GE <sub>SA</sub> }										
Ctry	Weak exogeneity test					Long-run causality result				
	Y_PC	FD	GE	FD <sub>SA</sub>	GE <sub>SA</sub>	Y_PC	FD	GE	FD <sub>SA</sub>	GE <sub>SA</sub>
B	0.201 (0.654)	6.691 (0.010)	4.966 (0.026)	0.221 (0.638)	0.675 (0.411)	Y	N	N	Y	Y
L	15.134 (0.000)	0.685 (0.408)	0.000 (0.983)	0.003 (0.958)	0.601 (0.438)	N	Y	Y	Y	Y
S	4.012 (0.045)	15.679 (0.000)	0.075 (0.785)	2.562 (0.109)	1.403 (0.236)	N	N	Y	Y	Y

Note: Y\_PC = GDP per capita; FD = financial development; GE = government expenditure

1. Values in (.) denote p-values; 2. Y ⇒ Fail to reject the null hypothesis of weak exogeneity = variable is weakly exogenous; N ⇒ Reject the null hypothesis of weak exogeneity; the variable is endogenous; 3. To decide on whether there cointegration or not, a 5% significance level is used in this article.

The South African variables are weakly exogenous in all the BLS countries. Therefore, there is unidirectional long-run causality from economic growth to financial development in Botswana and from financial development to economic growth for Lesotho. The causality results of economic growth to financial development for Botswana support the demand-following hypothesis. Evidence of the demand-following hypothesis supports the view by Hassan *et al.* (2011), who postulated that in developing countries, growth leads finance because of the increasing demand for financial services. Moreover, there is a possibility of bidirectional causality between economic growth and financial development for South Africa.

Given that financial development in Swaziland and Lesotho are stationary and are modelled as a cause of economic growth, the direction of causality from financial development to economic growth supports the supply-leading hypothesis. Regarding the South African spillovers, the weak exogeneity tests confirm the unidirectional causality from South African financial development and government expenditure to the BLS variables. Causality also runs from government expenditure to economic growth for all countries except Botswana, which suggests that fiscal policy could potentially lead to the growth of the economy if the sign is positive or hamper growth if it is negative.

However, weak exogeneity tests do not provide a full picture of the nature of the link among financial development, economic growth and government expenditure. Thus, the VECM results such as the sizes, signs and the level of significance of parameters supplement the weak exogeneity results to investigate how and to what extent financial development, economic growth and government expenditure are related. For the findings with two endogenous variables, two VECM models will be estimated, normalising on one endogenous variable at a time and the model with the better fit will be chosen. This means that the two VECMs for Botswana are normalised on FD and GE, the VECMs for Lesotho and Swaziland are normalised on economic growth, while for South Africa the two VECMs are normalised on financial development and economic growth.

VECM results in Tables 4a and 4b report the long-run standardised and unstandardized coefficients, short-run coefficients, the adjusted  $R^2$  results as well as the residual diagnostic tests for each country.

All models for the four countries pass the residual diagnostic checks, and thereby confirm the appropriateness of the cointegrating models reported. These tests show that the estimated cointegrating equations do not suffer from serial correlation, autocorrelation and heteroscedasticity. However, for Botswana and South Africa with two endogenous variables, and hence, two VECMs estimated, one of the VECMs has a low explanatory power indicated by an adjusted  $R^2$  below 30 percent. The threshold of 30 percent follows from Aziakpono (2008), who argues that this 30% explanatory power gives a relatively good fit for a model to be used. Those VECMs with low explanatory power are not reported in the table but are available on request. The VECMs with high explanatory power for Botswana and South Africa are normalised on financial development.

Table 4a: Estimated VECM results for South Africa

SA Model: VAR = {Y_PC, FD, GE}								
Ctry	Y	X	$\beta$	$\alpha$	Adj. $R^2$	LM	Portman-teau	White
SA	FD	Y_PC	0.159 <i>0.159</i> [1.559]	-0.499 [-3.554]	0.381	12.847 (0.170)	18.809 (0.279)	130.085 (0.249)
		GE	3.469 <i>1.122</i> [8.180]					

Note: 1. The coefficient signs are reported from the model with the endogenous variable on one side of the equal sign and the rest of the variables on the other side. Meaning the reported signs are the actual signs; 2. Values in italics denote standardised coefficients, calculated as the unstandardised coefficient multiplied by (standard deviation of the right-hand variable divided by the standard deviation of the left-hand variable), in parentheses [.] denote t-statistics, and in (.) denote p-values; 3. Y = variable the VECM is normalized on (endogenous variable); X = right-hand side variable; 4. LM is a test for serial correlation and its  $H_0$  is that there is no serial correlation; Portmanteau is a test for autocorrelation and its  $H_0$  is that there is no residual autocorrelation; White is a test for heteroskedasticity and its  $H_0$  is that there is no heteroscedasticity.

Regarding the relationship between financial development and economic growth, South Africa and Botswana indicate a significant positive effect of GDP per capita on financial development with coefficients of 0.159 and 0.201, respectively. These positive long-run coefficients mean that if the economy grows by one percentage point, in the long-run, the level of financial development also increases, *ceteris paribus*, by magnitudes of 0.159 and 0.201 percentage points for South Africa and Botswana respectively. This also indicates that as the economy grows, the development of the domestic financial system also improves; which is support for demand-following finance.

The standardised coefficients indicate that government expenditure is relatively more important to financial development in South Africa than economic growth.

In contrast, economic growth is the most important to financial development in Botswana. Moreover, Swaziland indicates a significant positive effect of financial development on economic growth, while Lesotho indicates an insignificant effect.

Table 4b: Estimated VECM results for BLS countries

Spillover Model: VAR = {Y_PC, FD, GE, FD <sub>SA</sub> , GE <sub>SA</sub> }								
Ctry	Y	X	$\beta$	$\alpha$	Adj. $R^2$	LM	Portman-teau	White
B	FD	Y_PC	0.201 <i>0.015</i> [2.795]	-0.281 [-4.531]	0.418	14.163 (0.959)	17.791 (0.999)	180.561 (0.474)
		GE	-1.507 <i>-0.008</i> [-5.884]					
		FD <sub>SA</sub>	-0.076 <i>-0.001</i> [-0.432]					
		GE <sub>SA</sub>	-2.622 <i>0.009</i> [-2.086]					
L	Y_PC	GE	1.506 <i>0.420</i> [4.083]	-0.173 [-6.240]	0.364	28.938 (0.267)	45.064 (0.511)	310.291 (0.776)
		FD	0.099 <i>0.013</i> [0.137]					
		FD <sub>SA</sub>	1.090 <i>0.316</i> [2.846]					
		GE <sub>SA</sub>	6.905 <i>0.536</i> [3.364]					
S	Y_PC	GE	-1.561 <i>-0.141</i> [-3.179]	-0.172 [-2.435]	0.376	27.199 (0.346)	36.835 (0.831)	178.362 (0.521)
		FD	1.722 <i>0.183</i> [4.003]					
		FD <sub>SA</sub>	1.550 <i>0.415</i> [8.278]					
		GE <sub>SA</sub>	8.165 <i>0.628</i> [12.477]					

Note: 1. The coefficient signs are reported from the model with the endogenous variable on one side of the equal sign and the rest of the variables on the other side. Meaning the reported signs are the actual signs; 2. Values in italics denote standardised coefficients, in parentheses [.] denote t-statistics, and in (.) denote p-values; 3. Y = variable the VECM is normalized on (endogenous variable); X = right-hand side variable; 4. LM is a test for serial correlation and its  $H_0$  is that there is no serial correlation; Portmanteau is a test for autocorrelation and its  $H_0$  is that there is no residual autocorrelation; White is a test for heteroskedasticity and its  $H_0$  is that there is no heteroscedasticity.

The significant positive coefficient of 1.722 for Swaziland means that if the level of development of the financial system improves by one percentage point, in the long-run, Swaziland's per capita economy also grows, *ceteris paribus*, by 1.722 percentage

points. This is an indication that financial development stimulates economic growth, which is support for the supply-leading hypothesis.

Focusing on the relationship between financial development and economic growth controlling for domestic government expenditure, the VECM results show that government expenditure has a significant impact on financial development in Botswana and South Africa, as well as a significant impact on economic growth in Lesotho and Swaziland. For Botswana, government expenditure negatively affects the country's level of financial development, which means that an increase in government expenditure is associated with a decline in financial development. This negative effect of government expenditure could be a reflection of the crowding-out effect of government spending on the private sector and possible inefficiencies caused by increased government expenditure (Cooray and Schneider, 2018). According to Badun (2013), an increase in government involvement constrains the development of financial systems due to increased fiscal deficits, the impediment of a higher future tax burden on the society, which then affects the credit demanded and extended to the private sector, and by extension, lead to reduced financial development. Considering that government expenditure in Botswana is mostly recurrent (or consumption expenditure) instead of capital expenditure, "...an increase in government consumption absorbs domestic liquidity outside of the financial system, hampering the effectiveness of intermediaries in mobilizing savings to support private sector activity" (Naceur *et al.*, 2014).

The South African VECM results show that government expenditure has a positive effect on financial development, with a coefficient of 3.469. The coefficient of 3.469 means that if the government expenditure increases by one percentage point, in the long-run, South Africa's financial development improves by 3.469 percentage points, *ceteris paribus*. This is an indication of the crowding in the effect of government spending, where increased public expenditure actually increases the demand for goods and financial services, and hence, financial development.

This positive effect of government expenditure is consistent with the development view where higher government expenditure promotes the degree of financial development in South Africa.

In addition, Swaziland government expenditure has a negative effect on the country's GDP per capita, while it has a positive effect on economic growth for Lesotho. The negative effect in Swaziland could be attributed to higher government expenditure displacing private sector activities, which then dampens growth (Carter *et al.*, 2013). This is also confirmed by the Swaziland finance minister, Neal Rijkenberg, in the 2019 budget speech, who advocates for an appropriate balance between government and the private sector because government actions such as public spending affect the environment that the private sector operates in and by extension economic growth. Therefore, the Swaziland government needs to control its spending and properly manage expenditure to boost the nation's productive capacity and accelerate economic growth.

The VECM results for Lesotho show that government expenditure has a positive effect on economic growth. The significant positive coefficient of 1.506 means that a one-percentage-point increase in government spending increase GDP per capita by 1.506 percentage points. The main implication is that Lesotho can consider government expenditure as a tool that fiscal authorities can use to influence economic activity as well as to correct short-term cyclical fluctuations in the economy. The standardised coefficients show that fiscal policy has a relatively higher effect on economic growth than financial development in both Lesotho and Swaziland. Some of the results in this article are similar to Aziakpono (2008)<sup>46</sup>, who also explored the relationship between economic growth and financial development for Swaziland and Lesotho, in that the VECMs presented in their study were mainly normalised on economic growth.

Furthermore, regarding spillover effects of South African financial development and government expenditure, Botswana experiences significant negative spillover effects from South African government expenditure, which is an indication that higher South African public spending impedes the development of Botswana's financial system. However, South African financial development spillover effects, although positive, are insignificant in Botswana, meaning that the development of financial systems in South Africa does not translate into an improvement of financial development in Botswana.

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<sup>46</sup> This similarity is only to a small extent because the control variables used in the specific VECMs in Aziakpono (2008) are different from the ones used in this thesis.

For Lesotho and Swaziland, financial development and government expenditure in South Africa have significant positive effects on the GDP per capita levels of Lesotho and Swaziland. Government expenditure standardised coefficient magnitudes are larger than those of financial development, which is an indication that government expenditure in SA has a larger influence on the Lesotho and Swaziland economies than South African financial development. The finding of a significant South African financial development means that further development of South African financial systems promotes economic growth in Lesotho and Swaziland. Also, positive spillover effects from South African government expenditure are an indication that higher South African public spending boost economic performance in Lesotho and Swaziland. Fiscal policy spillovers from South African to the BLS countries all indicate a relatively higher effect on financial development in Botswana and economic growth in Lesotho and Swaziland.

In addition to the long-run coefficients, Tables 4a and 4b also report the error correction terms. All the estimated short-run coefficients have the expected negative sign and magnitudes between 0 and -1, while also being statistically significant. The significant error correction terms imply that, in the presence of a disturbance, a particular variable adjusts to movements from its long-run relationship. Moreover, the size of an error correction term represents the speed of adjustment of the variable towards its long-run equilibrium (Aziakpono, 2006). The error correction results indicate varying speeds of adjustment (-0.499 to -0.172) from country to country. These magnitudes of the error correction terms mean that between 17.2 and 49.9 percent of the deviations of the variable from equilibrium is corrected in one year for the four countries. In summary, the results above show support for unidirectional causality from economic growth to financial development for Botswana and South Africa, and from financial development to economic growth for Lesotho and Swaziland.<sup>47</sup>

Government expenditure has a significant impact on financial development in South Africa and Botswana and on economic growth in Lesotho and Swaziland.

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<sup>47</sup> Because circumstances and relevant hypotheses can change over time, the relevant policymakers would need to monitor country developments over time and adjust policy behaviour accordingly. The relevant adjustments are necessary to minimise the threat this change could have on the high level of integration among the member countries.



The results also support the existence of significant financial development and government expenditure spillovers from South Africa to the economic growth of Lesotho and Swaziland as well as significant government expenditure spillovers from South Africa to Botswana's financial development.

## **5. CONCLUSION AND POLICY IMPLICATIONS**

The main objective of this article is to explore the role of domestic and South African fiscal policy and South African financial development on the relationship between financial development and economic growth of the SACU countries. Extensive research on the finance-growth nexus indicates that either financial development promotes economic growth or economic growth plays a vital role in the development of financial systems. The study is mainly motivated by this inconclusive literature, which indicates mixed results on the direction of causality between economic growth and financial development as well as the effects of fiscal and monetary policy on the finance-growth nexus. The time-series data used ranges from 1972 to 2017, and the Johansen cointegration framework is used to address the objective of the article.

The weak exogeneity tests used to establish causality among financial development, economic growth and government expenditure show that there is unidirectional causality from economic growth and government expenditure to financial development for South Africa and Botswana. This finding supports Patrick's (1966) demand-following hypothesis where real economic growth fosters the development of a financial system. However, for Lesotho and Swaziland, the weak exogeneity tests show that there is unidirectional causality from financial development and government expenditure to economic growth, which supports Patrick's (1966) supply-leading hypothesis. This hypothesis implies that having a better financial system will be helpful to have stable economic growth.

The cointegration and VECM analysis supplement the weak exogeneity tests by providing the magnitudes, signs, and significance levels of the estimated parameters indicating how financial development, economic growth, and government expenditure are related. From the cointegration analysis, the findings of this article confirm a significant positive effect of economic growth on financial development in Botswana and South Africa and of financial development on economic growth in Swaziland.

These support the demand-following hypothesis for Botswana and South Africa and the supply-leading hypothesis for Swaziland. This means that policymakers in Botswana and South Africa should focus on components promoting economic growth to boost the level of development of their financial systems. In contrast, policymakers in Swaziland seeking to stimulate economic growth, in the long run, need to ensure enhanced development of financial systems as it is a significant driver of economic growth.

Moreover, the VECM results suggest that fiscal policy crowds-out financial development in Botswana, while it crowds-in financial development in South Africa. The negative effect of government expenditure on financial development in Botswana could suggest that government expenditure, through an increased tax burden and inefficient market system, operates as one of the channels that divert resources away from the financial sector to the government, and in this way interferes negatively with the financial sector activities (Mahawiya, 2015). This finding implies that higher government spending increases uncertainty about fiscal sustainability, as it crowds out private investment, with adverse effects on the development of financial systems. This is support for the classical view, which postulates that government involvement in the financial sector hinders the development of financial systems.

Conversely, the positive effect of government expenditure on financial development in South Africa demonstrates that the effectiveness of fiscal policy improves the development of the financial system. Thus, government expenditure should be encouraged, within the bounds of a sustainable fiscal policy, to ensure it translates into an improved and developed financial system. This positive effect of government expenditure in South Africa is support for the development view by Cooray (2011), which asserts that higher government expenditure improves the development of financial systems.

The findings from the cointegration analysis also indicate that government expenditure has a significant positive effect on economic growth in Lesotho, which means that increased public expenditure is growth-enhancing in Lesotho. Therefore, there is support for the Keynesian hypothesis in Lesotho, which means that government expenditure can be used as a policy variable that fiscal authorities can use to influence economic growth.

However, there is a negative effect of government expenditure on economic growth in Swaziland, which implies that an increase in public spending inhibits economic prosperity. Given that the direction of causality runs from government expenditure to economic growth and that the VECM is normalized on economic growth, there is no evidence for the Wagner hypothesis.

The spillover analysis indicates that there are significant financial development and government expenditure spillovers from South Africa to the BLS countries. The implication that arises from these findings is that to promote economic growth in Lesotho and Swaziland, these countries should continue to strengthen their financial and fiscal policy linkages with South Africa to boost their economic performance. Bara and Le Roux (2017) suggest that further promoting financial market integration in the region is one approach that could reinforce the role of financial sector in transmitting spillovers across countries. The extended sample in the exploration of the relationship between financial development and economic growth gives, to a limited extent, different results from those of Aziakpono (2008). Therefore, this thesis brings in a different conclusion that fiscal policy domestic and foreign fiscal policy spillovers and financial development spillovers are important in the relationship between financial development and economic growth.

In summary, the analysis suggests that financial development, government expenditure, fiscal policy, and financial spillovers play a crucial role in boosting economic growth in Lesotho and Swaziland. In Botswana, economic growth, government expenditure, and fiscal policy spillovers play a key role in boosting financial development. Thus, acknowledging the nature and magnitudes of these variables on financial development and economic growth can highlight the need for complementarity and harmonised monetary and fiscal policies to improve the development of financial systems and economic performance (Loayza *et al.*, 2017).

Given that the SACU countries have different hypotheses, for higher level of integration within the region, each country would need to better understand its own needs within a more integrated framework. Because of these differences, fiscal policy actions, whilst coordinating with the common monetary policy, can differ across countries by paying cognizance to the local developments.

The above findings are relevant to policymakers in that they provide guidelines on whether or not financial development and fiscal policy can contribute to strategies used in enhancing economic growth. Also, these findings suggest that sound fiscal and monetary policy activities are essential to ensure the realisation of maximum potential gain for financial systems of the SACU countries. In other words, to improve the development of financial systems in the SACU countries, policymakers should consider the relationship between economic growth and financial development while also focusing on maintaining stable monetary and fiscal policies. Moreover, the governments of the other SACU countries should strive to boost their economic performance by taking into account the monetary and fiscal policy activities of South Africa as this could, in turn, lead to an improved financial sector performance and further macroeconomic stability.

Based on these findings, this article recommends, among other things, that to help boost financial sector development and amplify economic growth, policymakers in the SACU countries could pursue sustainable fiscal policies and take account of spillover effects of financial development and fiscal policy from South Africa. The positive effect of government expenditure implies that fiscal policy could be an important and useful channel for economic development and growth. Moreover, sustainable fiscal policy boosts macroeconomic stability, thereby creating the necessary pre-conditions for finance to thrive (Bittencourt, 2012).

However, due to data limitations, there are limitations to this study, which include small sample sizes used in the analysis due to data limitations and the use of only one indicator of financial development. The short sample period implies that the results of this study should be interpreted with some caution. Private sector credit, which serves as the financial development indicator in this article, is the most commonly used and accepted in the literature (Ibrahim and Alagidede, 2017). Despite these limitations, the findings of this article indicate the relationships between variables of interest and provide general insights into what contributes to the development of financial systems and sustainable economic growth in the SACU countries.

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## CONCLUSION

Interest in economic and monetary integration among groups of countries has been rising over the last three decades, with growing international interest emanating from the successful setup and launch of the EMU and the euro as the common currency of the EMU. According to McCarthy (2012), full monetary integration is one of the highest forms of integration, and it entails setting up a regional central bank that is responsible for the formulation and implementation of monetary and exchange rate policies, having a single currency as well as having formal regional surveillance of domestic economic (fiscal and structural) policies of the member countries. Full monetary integration, the key focus of this study, is a process which comprises various stages such as macroeconomic convergence, monetary integration, and monetary union at a regional level, with a single currency and central bank. The journey towards the formation of a complete monetary union involves preparatory stages of harmonising and linking macroeconomic and financial policies, institutions, and rules and regulations of the potential member countries.

Countries around the world have set up several arrangements towards attaining full monetary integration in their regions. Examples include SADC, ECOWAS, and the CFA Franc Zone. The SACU countries (South Africa, Botswana, Lesotho, Namibia, and Swaziland) are a subset of SADC. SACU is the longest-standing customs union in the world, with South Africa largely dominating the other four countries (Botswana, Lesotho, Namibia, and Swaziland – BLNS countries) economically. Four of the SACU countries are part of the Common Monetary Area (CMA), an asymmetric monetary union with no regional central bank, no shared pool of external reserves, no formal regional surveillance of domestic fiscal and structural policies, and no prescribed mechanism for fiscal transfers to cushion the impact of asymmetric shocks on member states (Masson and Pattilo, 2002; Asonuma, Debrun and Masson, 2012; Seleteng, 2013). This study assesses whether or not full monetary integration is feasible in the SACU region by drawing on the experience of the EMU. The EMU experience shows that achieving macroeconomic convergence at the national level is essential for full monetary integration, and that macroeconomic stability is a desirable outcome of macroeconomic convergence.



Ways of attaining macroeconomic convergence include member countries coordinating their actions, or alternatively having a dominant country in the region that steers the policy direction for smaller member countries. This thesis shows that the latter condition applies to the SACU region. Given that the spillover of policy from one country to other member countries is one of the aspects to be considered for macroeconomic convergence and stability, this study approached the convergence assessment from the view of establishing the extent of monetary and fiscal policy spillover and coordination among the SACU countries. Therefore, whether or not there is room for the SACU countries to create a full monetary union is examined by investigating the nature and degree of policy spillover effects and policy coordination across the region.

Furthermore, these macroeconomic policy operations and their spillover effects across borders affect growth prospects and the development of financial markets, while the extent of financial development can also affect the effectiveness of monetary and fiscal operations. Therefore, while controlling for South African financial development as well as domestic and South African fiscal policies, this thesis also investigated the nature of the relationship between economic growth and financial development in SACU countries.

Based on the discussion above, the main objective of the study was to ascertain the nature and extent of monetary and fiscal policy spillover effects and coordination in the SACU region. This main objective was addressed in four articles that explored the policy spillover effects and coordination and, hence, contributes to the argument for or against establishing a fully-fledged SACU monetary union as well as provide guidelines on a setup that will best accommodate policymaking in a spillover-rich macroeconomic policy environment. Specifically, the objectives of the four articles are as follows:

- i. To establish whether or not the South African dominance hypothesis holds in the SACU region;
- ii. To explore the extent and effects of SA monetary policy spillovers on the BLNS countries;
- iii. To determine the extent of coordination between monetary and fiscal policy, from a regional perspective;

- iv. To explore the role of domestic and South African fiscal policies, and South African financial development in the relationship between financial development and economic growth in the SACU countries.

To address these objectives, the study employed various econometric techniques, which include principal component analysis, Johansen cointegration techniques, Vector Error Correction modelling (VECM), Granger causality testing, Structural Vector Autoregressive (SVAR) modelling, the Diebold-Yilmaz (DY) spillover index, the Set-theoretic approach (STA), and policy reaction functions.

The focus of this thesis is limited to the discussion of the economic, fiscal and monetary preconditions for complete monetary integration. Hence, the institutional and political dimensions are not discussed. Therefore, an area of further research could be to study the political and institutional dimensions of full monetary integration to fully comprehend the feasibility of creating a full monetary union in the SACU region. The main contributions of the study include the presentation of original research on the nature of policy interactions in the SACU region, as well as assessing and estimating the nature and magnitude of policy spillovers and coordination in SACU, which is not a full monetary union. The study sought to answer the question whether or not there is an economic, fiscal and monetary policy case for SACU countries to move towards full monetary integration, as embodied in a monetary union.

The South African dominance hypothesis (SADH) and spillover analysis, based on the cointegration and error-correction framework, not only confirm the economic and monetary dominance of South Africa in the SACU region, but also highlights that there are significant economic and monetary policy spillovers from South Africa to the other SACU countries. Moreover, the principal component analysis indicates that SACU countries' economic and monetary sectors have become more integrated over time. More specifically, the monetary and economic dominant role of South Africa in the SACU region is evident in that any changes in the South African economic variables translate into changes in the variables of the BLNS countries. The BLNS countries, generally, respond symmetrically to the South African economic and monetary spillovers.

The significant South African monetary policy spillovers to the BLNS countries indicate the presence of a high level of financial linkages, openness and capital mobility among the SACU countries and the dependence of BLNS countries on South Africa's financial systems. The uniform presence of monetary policy spillovers, as well as strong spillovers of economic variables such as interest rates and inflation, predominantly from South Africa to the BLNS countries, therefore suggest some macroeconomic convergence in the region, justifying a move towards the successful establishment of a full monetary union.

However, the set-theoretical results indicated poor monetary and fiscal policy coordination within each of the SACU countries and between South Africa and the BLNS countries, while the results from policy reaction functions exhibit limited evidence of monetary and fiscal policy interactions. Specifically, the monetary policies of Botswana, Lesotho, and South Africa do not adjust to domestic or South African fiscal policies, but follow South African monetary policy, while in the Swaziland case, domestic fiscal policy conflicts with its own monetary policy. Additionally, Botswana fiscal policy responds to and coordinates with its own and South African monetary policies, while Lesotho fiscal policy only coordinates with South African monetary policy. South African and Swaziland fiscal policies do not coordinate or conflict with domestic and South African monetary policies. In view of the game-theoretic approach of Nash and Stackelberg outcomes, these findings imply monetary leadership for Botswana and Lesotho, where monetary policy leads fiscal policy. In contrast, Swaziland and South Africa indicate a Nash equilibrium, where the policy authorities do not take into account one another's reactions.

The less than perfect or even absent coordination of fiscal and monetary policies, both within countries, as well as among SACU countries, might undermine successful monetary integration. Significant policy spillovers and limited policy coordination signify the need for fiscal and monetary authorities to improve policy coordination. This can be done by, among other things, promoting a stable relationship between monetary and fiscal authorities, and, since high public debt levels can hamper coordination with monetary policy, ensuring proper public debt management (Ramlogan and Sookram, 2018). The coordination between fiscal and monetary policy within and between countries in a monetary union is not a trivial matter.

Lack of such coordination in the euro area in the early 2010s, when Italy and Greece experienced high and rising public debt burdens, threatened to undermine the very existence of the European Monetary Union. If the lack of such coordination threatens the existence of a monetary union as mature as the euro area, then emerging and potential monetary unions should pay special attention to ensure better coordination between fiscal and monetary policy. Not only will better coordination improve the opportunity to create a successful monetary union, but it will lead to better macroeconomic outcomes in general.

Regarding the role of domestic and South African fiscal policy and South African financial development in the relationship between financial development and economic growth of the SACU countries, the results indicate that there is unidirectional causality between economic growth and financial development, though the direction differs depending on the country. The findings for South Africa and Botswana support Patrick's (1966) demand-following hypothesis where real economic growth fosters the development of a financial system, while for Lesotho and Swaziland support Patrick's (1966) supply-leading hypothesis where causality runs from financial development to economic growth. The analysis also indicated that financial development, fiscal policy, and financial spillovers play a critical role in boosting economic growth in Lesotho and Swaziland. Moreover, economic growth and fiscal policy spillovers play a vital role in facilitating financial development in Botswana.

Acknowledging the nature of the relationship between financial development and economic growth, and the impact thereupon of South African fiscal policy and financial development, emphasises the need for harmonised monetary and fiscal policies (Loayza, Ouazad and Ranciere, 2017). According to the IMF (2016), promoting financial integration in the region is one approach that enhances the transmission of financial spillovers across countries. Moreover, the governments of the other SACU countries should strive to boost their economic performance by taking into account the monetary and fiscal policy activities of South Africa, as this could, in turn, lead to an improved financial sector performance and further macroeconomic stability of SACU countries. Policymakers in the SACU countries could ensure fiscal sustainability and consider spillover effects of financial development and fiscal policy from South Africa to help enhance financial sector development and strengthen economic growth.

A contribution of this study is that fiscal policy variables included in the analysis are significant which point to the importance of fiscal policy in the relationship between financial development and economic growth. The positive impact of government expenditure implies that fiscal policy could be an essential and useful channel for economic development and growth.

However, as much as the macroeconomic convergence and, to a more limited extent, policy coordination indicate an integrated SACU region, there is still more effort needed for the region to attain full monetary integration. The European Monetary Union experience has shown that it is not necessary to wait for the achievement of theoretically optimal conditions before coordinating policies, but rather that the process of coordination itself strengthens the process of real convergence. The experiences of West Africa, Europe, and Latin America also indicate that cooperation among countries requires a supranational institution to act as a catalyst and steer the process of full monetary integration. Nevertheless, the recent euro crisis highlights that fiscal integration is necessary before introducing a single currency even if the region satisfies all the other criteria of macroeconomic convergence and coordination (Harvey and Cushing 2015).

Therefore, before formulating a full monetary union, the SACU countries will need to design an appropriate set of convergence criteria, which takes into account the region-specific characteristics such as the dominant nature of South Africa over the BLNS countries. Because the SACU countries face the challenge of policy spillover effects and limited coordination between fiscal and monetary policy within the region, it is crucial to improve such coordination and thereby strengthen the credibility and sustainability of the monetary union. Moreover, a coordinated response of fiscal policy to monetary policy in some of the SACU countries is a good move towards the formation of a full monetary union because it means that the government (i.e. the fiscal policymaker) takes into account the stance of monetary policy. However, to ensure successful monetary integration requires that all SACU countries implement such a coordinated approach. Thus, to conclude, economic and monetary policy conditions favour monetary integration in the SACU countries, but for a monetary union to be truly successful will require better coordination between fiscal and monetary policy, both within and between countries.

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