

Examine the credit channel of the monetary policy transmission mechanism in an emerging market economy: the case of South Africa

Monetary
policy
transmission

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Abstract

Purpose – The purpose of this study is to analyze commercial bank-level data to examine a credit channel of the monetary policy transmission mechanism in emerging economies, such as South Africa from BRICS countries. Among the important questions that central banks, economists and policymakers have raised in this area are: Do bank characteristics and macroeconomic variables influence credit supply in South Africa? Do bank characteristics and macroeconomic variables interact to influence credit supply in South Africa?

Design/methodology/approach – Static panel data with pooled OLS, a random effect model and the fixed-effect model are used for data analysis. Using a sample of 50 commercial banks from South Africa over 10 years from 2009 to 2018. The statistical software Stata is utilized for data analysis.

Findings – The conclusion of this study shows that in South Africa, the loan amount has a strong and positive macroeconomic variable inflation effect. The outcomes of the study also revealed that in South Africa, there is a strong but negative association between interaction macroeconomic variables inflation and bank characteristic liquidity ratio on the loan amount.

Originality/value – The authors contribute to the existing literature by identifying the key determinants of monetary policy transmission channels through credit in South Africa and, furthermore, through a country-level data analysis and disaggregation at the commercial bank level, as well as economic conditions.

Keywords Monetary policy transmission mechanism, Loan supply, Panel data, South Africa

Paper type Research paper

1. Introduction

The transmission of monetary policy is a dynamic and fascinating topic in macroeconomic literature. According to the monetary policy transmission theory, an increase in the money supply can raise prices and, in theory, lead to an increase in economic output. Monetary policy is implemented via several transmission channels, including the credit channel, the interest rate channel, the exchange rate channel and the asset price channel. Among all channels, the credit channel has the potential to play an important role in addressing the issue of monetary policy transmission mechanisms (MPTMs). The credit channel is divided into two subchannels: the bank lending channel (BLC) and the balance sheet channel (BSC). The BLC has an impact on a firm's ability to obtain a bank loan. The BSC, on the other hand, describes the financial situations of firms and households, as well as their ability to access the

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credit market (Bernanke and Gertler, 1995). Thus, credit channels play an important role in the study of macroeconomic phenomena.

In the macroeconomic variables for the MPTM, the credit channel becomes a key channel. Furthermore, monetary policy transmission is an effective policy tool for influencing the economy. By utilizing bank advances to supply the economy, the channel functions as a critical system that clarifies the impact of monetary and monetary approaches (Mishkin, 1996). Furthermore, it is clear that a more extensive credit channel exists and that credit itself is dependent on the level of financial action. This implies the existence of a massive official division in the economy that relies on money associated with multiple countries for trade activities. It refers to fact that the critical role of bank loans and financial markets in bank advances and money market advancements (money division and capital market advancements) has serious consequences for the safety of the banking sector and credit markets (Altunbas *et al.*, 2009; Singh *et al.*, 2008). Therefore, it is critical to understand the channels via which monetary policy is transmitted throughout an economy.

In South Africa, Monetary policy with Reserve (SARB) bank tools changes the money supply in the economy. The SARB led monetary policy assessment of current and upcoming economic developments to recognize and provide financial stability. South Africa is one of the biggest producers of goods like gold, platinum and chrome, which are important resources to assist domestic and global economic growth (Biggemann and Fam, 2011). In South Africa, monetary policy is constantly correlated to a low inflation level for more than three decades in the past with the case of economic conditions the state has been challenging (Strydom, 2000). Table 1 shows the framework for monetary policy transmission in South Africa.

The effect of the channel for bank lending must be higher for banks having a lower level of liquid assets and capital. Banks with lesser liquidity are not able to protect their loan portfolios against the tightening of monetary policies just by drawing out fewer securities as well as cash (Kashyap *et al.*, 2002; Kashyap and Stein, 2000). Banks that do not have good capital have lesser accessibility to markets for funds that are not insured. The studies on cross-section differences in the efficacy of the channel for bank lending are from the development economies (Kishan and Opiela, 2000; Peek and Rosengren, 1995; Van den Heuvel, 2002).

There are numerous studies examining the MPTM or related subjects for South Africa. According to Pandit and Vashisht (2011), the finding has been shown that the bank loan and interest rates have a negative relationship, and there is an impact on the credit channel in South Africa. In another research (Gumata *et al.*, 2013), the finding has been indicated that credit channels and interest rates are more significant in South Africa. The analysis of Christensen and Kwan (2014) shows that there is a strong and considerable MPTM expectations.

According to Sichei (2005), the finding showed that with the rise in monetary policy transmission, the bank loan declines among large banks, and the well-capitalized bank could be an impact of monetary policy. Similarly, the result of Lungu (2007) has indicated that there is a bank lending channel in South Africa. Additionally, the result of Walker (2012) showed that the bank lending channel is not statistically significant. According to Kapan and Minoiu (2013), during the recent financial crisis, the bank balance sheet is strong for maintaining

Table 1.
Monetary policy transmission mechanism frameworks in South Africa

Monetary policy framework, % , year of acceptance	Key monetary policy tools	Objectives
Inflation targeting (4.5%) (2000)	Key policy rate: repurchase rate	The inflation target range for headline CPI of percent cent combined with the financial stability objective

Source(s): The South Africa Reserve Bank: www.Redbank.co.za

lending and reducing liquidity and more dependent on investment and less credit supply than other banks. On the other hand, [Ludi and Ground \(2006\)](#) discovered that there is no significant bank lending channel. According to [Yu and Hsieh \(2014\)](#), the bank lending channel is agreed in South Africa; for instance, an expansionary monetary policy with less policy rate would decline the cost borrowed by the bank.

More recently research, [Balcilar *et al.* \(2017\)](#) showed that the fluctuation of monetary policy transmission is high and steady. Also, the interest rate and inflation decline in response to uncertainty. After the synchronized decline, the GDP returns quickly. The finding of research ([De Waal and Van Eyden 2014](#)) has been demonstrated that in South Africa, the monetary policy transmission is significant and efficient and guarantees for appropriate policy activities. According to [Farajnezhad and Suresh \(2019\)](#), the analysis includes evidence on the credit channel in the case of Malaysian commercial banks. The discovery indicates that there is a credit channel in the case of Malaysia. The changes in monetary policy and interest rates in the previous year will have an effect on credit supply in the current year. According to the findings by [Farajnezhad \(2021\)](#), there is a significant and positive relationship between macroeconomic indicators and interest rate and loan amount. Furthermore, in Brazil, there is a large and positive association between macroeconomic variables affecting GDP and loan amount. The macroeconomic variable inflation of loan amounts is substantial and negative in Brazil. The association between GDP–ROA interactions and GDP interactions with the total loan amount assets is considerable but negative. Moreover, the link between GDP and total assets interaction, GDP and return on assets and inflation on interaction with the total assets of credit amounts is significant and positive. The finding of [Bonga-Bonga \(2010\)](#) has indicated that in South Africa, the operation of the MPTM could be effective. The study by [Akinsola and Ikhide \(2018\)](#) indicates that there is a significant relationship between the business cycle and credit to GDP. There are few empirical studies on credit in South Africa ([Akinboade and Makina, 2009, 2010](#); [Fourie *et al.*, 2011](#); [Liu and Seeiso, 2012](#); [Raputsoane, 2014](#)).

An overall empirical study on monetary policy transmission in South Africa has been conducted ([Akinboade and Makina, 2009](#); [Andrianova *et al.*, 2010](#); [Aron and Muellbauer, 2007](#); [Aziakpono *et al.*, 2007](#); [De Angelis *et al.*, 2005](#); [Du Plessis *et al.*, 2007](#); [Fadiran and Edun, 2013](#); [Faure, 2005](#); [Fielding and Shields, 2005, 2006](#); [Gumata *et al.*, 2013](#); [Gupta *et al.*, 2010](#); [Kasekende and Brownbridge, 2011](#); [Menyah *et al.*, 2014](#); [Naraidoo and Gupta, 2010](#); [Ncube and Ndou, 2011, 2013](#); [Owusu-Sekyere, 2017](#); [Smal and De Jager, 2001](#)).

For research hypotheses development, this study considers the investigation of the elements of banks' capital structure applying the greatest extensive banks-level panel data of South Africa involving listed commercial banks from 2009 to 2018, which completely covers the period after the financial crisis on the research objectives.

Expansion investigations have a broad focus, addressing a wide range of topics ranging from social and economic concerns to diplomatic, environmental and humanitarian issues. This research focuses on the economic phenomena of the credit channel of monetary policy transmission in South Africa, which is appropriate for an expansion study because credit networks are an unavoidable predictor of economic growth and provide important information to policymakers.

The following questions are addressed in this study: (1) How do bank characteristics and macroeconomic variables affect credit supply in South Africa? (2) Do the characteristics of banks and macroeconomic variables influence credit supply in South Africa? This study contributes to the credit channel by describing the MPTM that determines South African banks' lending behavior. The results demonstrated that the questions were answered by identifying some significant positive and insignificant negative influences on the amount of loans (credit supply) in South Africa. In South Africa, it has been established that there is a positive and significant macroeconomic variable inflation with the amount of loan impact.

The study's findings also demonstrated a significant but negative relationship between the interaction macroeconomic variables of inflation and the bank's characteristic liquidity ratio on the amount loaned in South Africa.

The empirical analysis is based on a sample of 50 South African commercial banks from 2009 to 2018. The selection of this country enables for a more in-depth investigation of the influence of banks' loan supply reactions to the monetary policy via the credit channel while eliminating the bias caused by differing monetary policies. Furthermore, our dataset spans the whole period in which the South African economy was subjected to a single monetary policy conducted by the central bank of developing nations. The statistical program STATA 14 is used to analyze the results. For panel data, the investigation is carried out using the fixed-effect model and random effect model methodologies. This methodology permits controlling both unobservable heterogeneity and the problems of endogeneity between monetary policy and the characteristics of banks using tools. This methodology yields consistent and unbiased estimates of the relationships between macroeconomic variables and bank-specific characteristics.

The rest of the paper is structured as follows. The related materials and methods are explained in [Section 2](#). [Section 3](#) describes empirical analysis and Random effect model. [Section 4](#) summarizes the conclusion of the study.

2. Methods

The bank scope dataset provided by Fitch's International Bank Database is used in this investigation. The study, which lasted from 2009 to 2018, was limited to commercial banks. The final panel sample is made up of 50 banks and 240 annual observations. Macroeconomic data (such as real GDP growth rates, interest rates and inflation rates) are provided by the International Monetary Fund (IMF) and the World Bank Development Indicator (WDI).

Based on the balance sheet, this study extracts the cross-sectional relevance of the accessibility of credit availability after the financial crisis to examine the bank credit channel ([Kashyap and Stein, 2000](#)) for the bank lending channel ([Bernanke et al., 1996](#)). According to the theoretical works ([Bernanke et al., 1999](#); [Holmstrom and Tirole, 1997](#)), this study concentrates on bank capital ratio. Meanwhile, based on the study by [Kashyap and Stein \(2000\)](#) and [Bernanke et al. \(1996\)](#), this research also determines the bank liquidity ratios ([Ehrmann et al., 2003](#); [Gambacorta, 2005](#); [Gunji and Yuan, 2010](#); [Jiménez et al., 2012](#); [Jiménez et al., 2014](#); [Juurikkala et al., 2011](#); [Mar'ia Cantero Saiz et al., 2017](#)). In this research, we control macroeconomic variables by real GDP growth, interest rate and inflation rate.

This study focuses at the interaction between the monetary policy index and bank characteristics including capital, liquidity and size to see how these factors affect lending reactions to the MPTM. [Table 2](#) displays the variables used in the regression models for loan amounts and their determinants, as well as the variable notation used in the prior section.

This study approach's evaluation is based on the contributions of ([Ehrmann et al., 2003](#); [Gambacorta, 2005](#); [Gunji and Yuan, 2010](#); [Jiménez et al., 2012](#); [Jiménez et al., 2014](#); [Kashyap and Stein, 1995](#); [Kishan and Opiela, 2000](#); [Mar'ia Cantero Saiz et al., 2017](#)). These researchers emphasize the importance of a few sorts of heterogeneity concerns for monetary policy transmission and suggest an interaction model between the policy instrument and the claimant base of heterogeneity. In this investigation, a comparable activity was carried out. The response of the credit supply to monetary shocks is the subject of analytical studies on banks' role in the MPTM. This study contains interaction terms between monetary policy factors and the bank-specific characteristics (size, LIQ and CAP) to capture the effect that these characteristics have on monetary policy fluctuations.

Table 2.
Definition of variables

Variables	Units	Definition
<i>Dependent variable</i>		
Ln Δ amount loan it	00.00.00	The growth rate of loans lagged for one year (log difference in the total loans)
<i>Independent variables</i>		
<i>Macroeconomics condition (t)</i>		
Δ IR t interest rate	%	Annual change of the country 3-month interbank interest rate. Calculated as the nominal interest rate minus inflation in country j at time t
Δ GDP	%	Annual change of the country Real GDP growth (YOY) in country j at time t
Δ Inflation rate	%	Annual change of the country Consumer Price Index, the (end of the year) change in CPI in country j at time t
<i>Bank characteristic(b)</i>		
Δ Bank capital it	%	The ratio of bank equity over total assets of the bank
Δ Bank liquidity it	%	The ratio of liquid assets (cash and balance with central bank, and loans and advances to governments and credit institutions) held by the bank over the total assets of the bank
Ln total assets it	-	The log of the total assets of the bank
ROA it	%	The total net income over assets of the bank

The model employs the following equation, which involves terms of interaction generated from a monetary strategy indicator and a bank-specific characteristic. The following equation defines the model for static linear panel data:

$$\begin{aligned} \text{Ln}\Delta \text{ amount loan}_{it} = & \beta_1 \Delta \text{IR}_t + \beta_2 \Delta \text{GDP}_t + \beta_3 \Delta \text{INF}_t + \beta_4 \text{capital ratio}_{it-1} + \beta_5 \text{liquidity}_{it-1} \\ & + \beta_6 \text{Ln total assets}_{it-1} + \beta_7 \text{ROA}_{it-1} + \beta_8 (\Delta \text{IR}_t \times \text{CAP}_{it-1}) \\ & + \beta_9 (\Delta \text{IR}_t \times \text{LIQ}_{it-1}) + \beta_{10} (\Delta \text{GDP}_t \times \text{CAP}_{it-1}) \\ & + \beta_{11} (\Delta \text{GDP}_t \times \text{LIQ}_{it-1}) + \beta_{12} (\Delta \text{INF}_t \times \text{CAP}_{it-1}) \\ & + \beta_{13} (\Delta \text{INF}_t \times \text{LIQ}_{it-1}) + \beta_{14} (\Delta \text{GDP}_t \times \text{Ln Total assets}_{it-1}) \\ & + \beta_{15} (\Delta \text{GDP}_t \times \text{ROA}_{it-1}) + \beta_{16} (\Delta \text{INF}_t \times \text{Ln Total assets}_{it-1}) \\ & + \beta_{17} (\Delta \text{INF}_t \times \text{ROA}_{it-1}) + \beta_{18} (\Delta \text{IR}_t \times \text{Total assets}_{it-1}) \\ & + \beta_{19} (\Delta \text{IR}_t \times \text{ROA}_{it-1}) + \varepsilon_{it} \end{aligned}$$

3. Results

3.1 Correlation variables matrix

Table 3 shows correlation factors with logarithm amount loan as a dependent variable based on credit channel and independent variables in the country of South Africa. Some of the bank components and macroeconomic indicators are significantly associated, whereas others are not. According to Table 2, there is just one significant and positive correlation coefficient between ROA and liquidity ratio (0.15, $p < 0.05$). Furthermore, there is no association coefficient between ROA and any other variable. The capital ratio and its interaction with GDP, on the other hand, are tightly connected ($r = 0.97$), indicating the presence of a multicollinearity problem. However, the capital ratio and its interaction with GDP are strongly linked ($r = 0.97$), indicating the presence of a multicollinearity issue. However, because the capital ratio and the interaction between GDP and capital ratio are not used in the

Table 3.
Correlation variables in
South Africa

	AL	TA	ROA	LIQ	CAP	GDP	INF	IR	GDP × LIQ	GDP × CAP	INF × LIQ
AL	1										
TA	0.2077***	1									
ROA	0.0538	0.0103	1								
LIQ	0.0687	-0.2541***	0.1545**	1							
CAP	-0.1753**	-0.4683***	0.1138	-0.0919	1						
GDP	-0.1286**	0.0144	-0.0624	0.0037	0.0138	1					
INF	-0.1261	-0.0364	-0.0382	0.0341	0.0342	0.316***	1				
IR	-0.1755**	-0.0291	-0.0511	0.042	0.0041	0.4195***	0.07844***	1			
GDP × LIQ	-0.0156	-0.1518**	0.0543	0.5756***	-0.0765	0.5110***	0.1447**	-0.1320**	1		
GDP × CAP	-0.0585	-0.2637***	0.0115	-0.073	0.9729***	0.3806***	0.1160*	0.1333**	0.1905***	1	
INF × LIQ	-0.014	0.0183	-0.0213	-0.0754	0.0238	-0.1102*	0.5665***	0.1621*	-0.1845***	-0.0421	1
INF × CAP	-0.2396***	0.0474	-0.0917	0.0918	-0.1404**	0.0442	0.4154***	0.2286***	0.0233	-0.0366	-0.0366
IR × LIQ	-0.0222	0.0079	0.0262	-0.0411	0.0028	-0.3367***	0.3448***	0.3504***	-0.4184***	-0.1477**	0.5930***
IR × CAP	-0.3073***	-0.0031	0.1253	0.1124	-0.0333	0.0271	0.02469***	0.02967***	-0.0168	0.0814	0.1059
GDP × TA	-0.1198*	0.3719***	-0.0205	-0.0953	-0.1495**	0.8749***	0.2746***	0.3631***	0.3446***	0.1761***	-0.0787
GDP × ROA	0.0218	0.0644	0.339	0.1272**	-0.0669	0.1695*	0.0151	0.016	0.2400***	-0.0295	-0.1093
INF × TA	-0.1291**	-0.1196	-0.0054	0.0951	0.0589	0.3085***	0.9282***	0.7323***	0.1572**	0.1470**	0.4886***
INF × ROA	-0.0361	0.0508	-0.1535	-0.0107	-0.0869	-0.1128*	0.3888	0.1316**	-0.1565**	-0.1451**	0.6035***
IR × TA	-0.2167***	-0.1112	-0.0264	0.0938	0.05	0.3988***	0.7276***	-0.9330***	0.1406**	0.1504**	0.1356**
IR × ROA	-0.0106	-0.0635	0.0149	0.0669	0.024	-0.2586***	0.2614***	-0.2536***	-0.1055*	0.0403	0.2118***

(continued)

	INF × CAP	IR × LIQ	IR × CAP	GDP × TA	GDP × ROA	INF × TA	INF × ROA	IR × TA	IR × ROA
AL									
TA									
ROA									
LIQ									
CAP									
GDP									
INF									
IR									
GDP × LIQ									
GDP × CAP									
INF × LIQ									
INF × CAP									
IR × LIQ	1	0.1971***							
IR × CAP	0.8277***	0.2099***	1						
GDP × TA	0.0787	-0.2675***	0.0055	1					
GDP × ROA	-0.0661	-0.1761***	-0.0365	0.1890***	1				
INF × TA	0.3429***	0.2986***	0.2194***	0.2629***	0.032	1			
INF × ROA	0.3859***	0.3807***	0.1235**	-0.0633	-0.1586	0.3406***	1		
IR × TA	0.2004	0.3020***	0.2715***	-0.3583***	-0.0219	0.7894***	0.1116	1	
IR × ROA	0.0776	0.3733***	0.0815***	0.3436***	-0.0402	0.3547***	0.1212	0.3376***	1

Note(s): The table presents the Pearson correlation coefficients among variables with their significance
*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level
Values in italics indicate the presence of a multicollinearity problem

Table 3.

same regression model, multicollinearity between independent variables does not affect the regression outcome. Similarly, the interaction between the inflation rate and size as well as the interaction between GDP and size with GDP are strongly linked ($r = 0.92$ and $r = 0.87$, respectively), suggesting the existence of a multicollinearity problem. However, multicollinearity between independent and dependent variables has no effect on the regression result. For example, the variable of inflation rate with the interaction between inflation rate and size, as well as the interaction between GDP and size with GDP, would not affect the regression result.

3.2 Multicollinearity test

Table 4 displays the variance inflation factor (VIF) of South African country-level variables. The tolerance values for the key variables range from 0.3755 to 0.946986. Furthermore, the major variables' VIF values range from 1.06 to 2.66; tolerance values for key variables of interaction variables range from 0.158011 to 0.757612; and the VIF values vary from 1.32 to 6.33 for all variables. The findings show that all the variables have tolerances greater than 0.1, indicating that the VIF is less than the proposed threshold value of 10. Hair *et al.* (2011). In other words, the tolerance and VIF values of the variables in this study are within the recommended limits.

3.3 Unit root test

Table 5 depicts the unit root test in South Africa. According to the country sample, South Africa's dependent variable (Ln amount loan) lacks a unit root. In the overall sample, the computed ADF (Augmented Dickey-Fuller) test statistic with lags (0) is -0.7967 , and the PP (Phillips-Perron) test statistic with lags (0) is -1.4918 . In South Africa, the liquidity ratio, capital ratio, total assets, GDP, INF, IR and interaction variables do not have a unit root. As a result, there is a stationary. Furthermore, all variables, including dependent and independent variables, have significant p -values. So, we reject H_0 and accept H_1 . This means that none of the variables in this research have a unit root issue and that the data are stationary.

	Variable	View	1/VIF (tolerance)
With main variables	Δ IR	2.66	0.37551
	Δ INF	2.48	0.403512
	Ln total assets	1.35	0.741004
	Liquidity Ratio	1.21	0.825729
	Δ GDP	1.2	0.832659
	Capital ratio	1.17	0.853429
	ROA	1.06	0.946986
	<i>Mean VIF</i>	<i>1.59</i>	
With main and interaction variables	Δ INF \times Liquidity Ratio -1	6.33	0.158011
	Ln total assets	6.01	0.166488
	Δ GDP \times Capital Ratio -1	5.96	0.167888
	Δ INF \times Capital Ratio -1	5.45	0.183626
	Capital Ratio -1	5.13	0.194899
	Δ IR \times Liquidity Ratio -1	4.76	0.210262
	Δ GDP \times Liquidity Ratio -1	4.41	0.226814
	Δ INF \times ROAt -1	3.19	0.313067
	Δ IR \times ROAt -1	2.84	0.352173
	Liquidity Ratio	2.83	0.353451
	Δ IR \times Capital Ratio -1	2.77	0.360877
	Δ GDP \times ROA -1	1.35	0.742207
	ROA	1.32	0.757612
	<i>Mean VIF</i>	<i>4.02</i>	

Table 4.
Variance inflation
factor (VIF)

Note(s): Values in italics indicate the presence of a multicollinearity problem

	Variables	ADF*	Lags	PP**	Lags
With main variables	Ln Δ amount loan	-0.7967	0	-1.4918	0
	Liquidity ratio	-3.967	0	-5.5323	0
	Capital ratio	-6.0357	0	-13.412	0
	Ln total assets	-0.796	0	0.0736	0
	ROA	5.1182	0	-3.0269	0
	Δ GDP	-8.8451	0	-10.893	0
	Δ INF	-11.258	0	-13.929	0
	Δ IR	-21.143	0	-36.689	0
	With interaction variables	Δ GDP \times Liquidity Ratio -1	-5.4855	0	-5.3541
Δ GDP \times Capital Ratio -1		-5.3826	0	-5.2396	0
Δ INF \times Liquidity Ratio -1		-14.314	0	-17.968	0
Δ INF \times Capital Ratio -1		-14.883	0	-20.397	0
Δ IR \times Liquidity Ratio -1		-3.2433	0	-2.9811	0
Δ IR \times Capital Ratio -1		-2.8575	0	-2.5501	0
Δ GDP \times Ln total assets -1		-8.3837	0	-10.171	0
Δ GDP \times ROA -1		-6.3261	0	-8.6418	0
Δ INF \times Ln total assets -1		-11.027	0	-13.574	0
Δ INF \times ROA -1		-14.453	0	-19.848	0
Δ IR \times Ln total assets -1		-20.307	0	-34.3	0
Δ IR \times ROA -1		-2.5582	0	2.8097	0

Note(s): *ADF (Augmented Dickey-Fuller)

**PP (Philip- Perron)

Table 5.
Unit root test in South
Africa

3.4 Random effect model

This section focuses entirely on unbalanced panel data that includes 50 commercial banks listed in the bank scope in South Africa. The following equation assesses the association between the bank-level determinants and the amount of loans using the pooled OLS and random effect analysis:

$$\begin{aligned}
 Ln \Delta amount \text{ loan}_{it} = & 0.5729407 + 0.2092575\Delta IR_t - 0.4891082\Delta GDP_t + 0.7404787\Delta INF \\
 & - 1.446708\text{capita ratio} - 0.1835404 \text{liquidity ratio} \\
 & - 0.0081471Ln \text{ total assets} + 0.0062086 ROA \\
 & + 0.6382598(\Delta IR_t \times CAP_{it-1}) - 0.2930166(\Delta IR_t \times LIQ_{it-1}) \\
 & - 0.9536829(\Delta GDP_t \times CAP_{it-1}) + 0.2460061(\Delta GDP_t \times LIQ_{it-1}) \\
 & - 0.6514908(\Delta INF_t \times CAP_{it-1}) - 0.7353581(\Delta INF_t \times LIQ_{it-1}) \\
 & + 0.0170307(\Delta GDP \times Ln \text{ total assets}) + 0.0063938(\Delta GDP \times ROA) \\
 & - 0.0404171(\Delta INF \times Ln \text{ total assets}) \\
 & - 0.015999(\Delta INF \times ROA)0.0622246(\Delta IR \times Ln \text{ total assets}) \\
 & + 2.03e - 06(\Delta IR \times ROA) + \varepsilon_{it}
 \end{aligned}$$

Table 6 shows that inflation INF (independent variable) is statistically significant and positively computed (coefficient = 0.74) with a p -value ($0.039 p < 0.05$) based on the results of a random effect model GLS regression with robust standard error adjusted in South Africa.

Random effect model-South Africa		Random-effects GLS regression	p-value	Robust standard error
Variables				
ROA		0.0062086 (0.0202713)	0.709	0.0166454
Ln total assets	Standard error	-0.0081471 (0.0493475)	0.879	0.0536466
Liquidity Ratio	Standard error	-0.1835404 (0.5792232)	0.813	0.7755689
Capital Ratio	Standard error	-1.446708 (1.008761)	0.352	1.55315
ΔGDP	Standard error	-0.4891082 (0.2302731)	0.245	0.4209294
Δ INF	Standard error	0.7404787 (0.2759578)	0.039***	0.358684
Δ IR	Standard error	0.2092575 (0.3092243)	0.486	0.3000809
Δ GDP × Liquidity Ratio	Standard error	0.2460061 (0.266479)	0.509	0.3728323
Δ GDP × Capital Ratio	Standard error	0.9536829 (0.4823235)	0.205	0.751713
Δ INF × Liquidity Ratio	Standard error	-0.7353581 (0.3908812)	0.009***	0.2816355
Δ INF × Capital Ratio	Standard error	-0.6514908 (0.7025894)	0.338	0.6796619
Δ IR × Liquidity Ratio	Standard error	-0.2930166 (0.6640016)	0.599	0.5568328
Δ IR × Capital Ratio	Standard error	0.6382598 (0.8825906)	0.574	1.134465
Δ GDP × Ln total assets	Standard error	0.0170307 (0.0246533)	0.650	0.0375303
Δ GDP × ROA	Standard error	0.0063938 (0.0090434)	0.262	0.0056971
Δ INF × Ln total assets	Standard error	-0.0404171 (0.0242015)	0.131	0.0267489
Δ INF × ROA	Standard error	-0.015999 (0.0287054)	0.625	0.032752
Δ IR × Ln total assets	Standard error	-0.0622246 (0.0291804)	0.103	0.0381920
Δ IR × ROA	Standard error	2.03e-06 (2.49e-06)	0.382	2.33e-06
Constant	Standard error	0.5729407 (0.471715)	0.291	0.5430295
R-sq		within = 0.3178 between = 0.3389 overall = 0.3201		
Modified Wald test for group		1087.64		
$\chi^2(12) = (b-B)-[(V_b-V_B)^{-1}](b-B)$		8.37		Hausman test
Prob > χ^2		0.9727		

Table 6.
Random effect in South
African country

Note(s): *** Significant at the 1 percent level. ** Significant at the 5 percent level. *Significant at the 10 percent level

The interaction between Δ INF and liquidity ratio (independent variables) has a significant but negative impact on the logarithm of the loan amount (dependent variable) calculated (coefficient = -0.73) with p -value (0.009 $p < 0.01$). Therefore, the research has a null hypothesis, $H_0 = 0$ and $H_1 \neq 0$. So, based on the result, the hypothesis H_0 is rejected and H_1 is accepted. This means the variables of inflation and interaction Δ INF and liquidity ratio influence the logarithm amount of loans in the South African economy in the period from 2009 to 2018.

Other main interaction variables such as ROA, Ln total assets, liquidity ratio, capital ratio, Δ GDP, Δ IR, Δ GDP \times liquidity ratio, Δ GDP \times capital ratio, Δ INF \times capital ratio, Δ IR \times liquidity ratio, Δ IR \times capital ratio, Δ GDP \times Ln total assets, Δ GDP \times ROA, Δ INF \times Ln total assets, Δ INF \times ROA, Δ IR \times Ln total assets and Δ IR \times ROA are insignificant. This means these variables did not influence the amount of loans in the South African country sample for the period of 2009–2018. To summarize, while the coefficients of the interaction terms between bank characteristics and monetary policy are too small to be statistically significant for the bank characteristics used in the analysis, the size of the coefficient is larger for the interaction term between liquidity and monetary policy and to a lesser extent for the coefficient of bank size and monetary policy. The magnitude of their coefficients in the interaction term for capitalization is rather tiny. The findings indicate that liquidity, rather than other bank characteristics, plays the most important role in tracking the variance response of bank loans to monetary policy. The study by [Ehrmann et al. \(2003\)](#) and [Kashyap et al. \(1996\)](#) stress the role of bank size, and the study by [Altunbas et al. \(2004, 2006\)](#) offers evidence of the vital role of capitalization.

This study comprehensively examines the effects of heterogeneity of bank characteristics, macroeconomic variables and interaction factors on credit supply among commercial banks in South Africa. The discussion of the key findings in this section is based on the two research objectives established in the introduction section. By elaborating on the empirical findings in connection with the relevant literature, the results could be generalized with a better level of understanding of the subject matter.

ROI. To examine the effect of heterogeneity of bank characteristics and macroeconomics variables on credit supply among commercial banks in South Africa.

According to the research, inflation has a statistically significant but negative impact on the amount of loans. The robust standard error coefficient indicated a likely causal link between the variables. Furthermore, the P -value indicates whether the hypothesis should be accepted or rejected. The p -value reflecting the importance of hypothesized associations ($p = 0.039$) was significant. As a result, this study discovered sufficient evidence to refute the hypothesis of a positive and substantial influence on loan amount.

According to the findings of this study, there is no significant relationship between the amount of loans and the interest rate in South Africa. It contradicts the conclusion of [Pandit and Vashisht \(2011\)](#), the finding shows that the bank loan and interest rate have a negative relationship, and there is an impact on the credit channel in South Africa. In another research ([Gumata et al., 2013](#)), the finding indicates that credit channels and interest rates are more significant in South Africa. Also, the study by [Kashyap and Stein \(2000\)](#) shows that a rise in interest rate changes the loan supply and accordingly decreases the total of credit available to type new loans. On the other hand, the study by [Sun et al. \(2010\)](#), to find the reality of a bank lending system for monetary policy transmission in China revealed that in the long run, bank loan supply is negatively related to obligatory reserve ratios and the official one-year lending pace, indicating that the bank lending channel plays an important role in China's monetary policy transmission. This research, however, is consistent with the study of [Fang et al. \(2018\)](#), In banks with official-and-director (OAD) status, the relationship between monetary policy and bank loans is insignificant, which

means that while researching the part of OAD, the lending channel of monetary policy is lacking. Finally, the assumptions of the study show that the interest rate, GDP, capital ratio, liquidity ratio, total assets and ROA have a statistically insignificant influence on the loan amount. As a result of this research, there is enough data to support the hypothesis of a non-significant influence on loan size.

RO2. To investigate the interaction of the impact of bank characteristics and macroeconomic variables on credit supply among commercial banks in South Africa.

Based on the findings of the South African data, the hypothesis of interaction inflation with liquidity ratio, as explained in this paper, has a statistically significant but negative influence on the amount of loans. The robust standard error coefficient was negative, indicating a likely causal link between the variables. Furthermore, the *P*-value indicates whether the hypothesis should be accepted or rejected. The *p*-value reflecting the importance of hypothesized associations was significant at level 0.01 ($p = 0.009$). As a result, this study showed sufficient data to reject the hypothesis of a negative and significant effect of the loan.

This study is consistent with studies from both developing and developed economies. For instance, the findings of [Van Ees and Garretsen \(1994\)](#) show the overall effect of liquidity on commercial investment and the relationship between companies and banks are equally suggestive of the official structures of the Dutch market for investment funds. [Wagner \(2007\)](#) indicated that when a bank's liquidity rises inconsistently, the banking unsteadiness and externalities associated with banking collapse directly enhance stability by driving banks to reduce the risks on their balance sheets.

The study by [Khwaja and Mian \(2008\)](#) shows that the lending moving to large firms could be riveting entirely, and there are no signs the bank liquidity shocks on aggregate effects. According to the study by [Cornett et al. \(2011\)](#), it has been demonstrated that the drop in credit of bank production during the crisis might be represented by the display of liquidity risk. The study of [Ruziq \(2013\)](#) findings shows that there is a positive significant relationship between the liquidity ratio and the return on assets. Consistent with previous research, this analysis found that the interaction of inflation and liquidity ratio had a statistically significant influence on the amount loaned in South Africa.

4. Conclusion

This article examines the credit channel of the MPTM in developing economies, specifically those from the BRICS countries, using commercial bank-level data from 2009 to 2020 in South Africa. The author of this study has identified that in South Africa, according to the study's results. In South Africa, there is a significant and positively connected macroeconomic variable inflation with loan amount effect. The study's findings additionally demonstrated a continuous economic integration and a significant but negative relationship between interaction macroeconomic variables interest rate and bank characteristic liquidity ratio on loan amount in South Africa. Based on the findings presented above, it is reasonable to conclude that banks in South Africa respond to monetary policy in a variety of ways. The study is beneficial to banks, central banks and economic policymakers. Policymakers should rely on the findings on the amount of money lent to comprehend the significance of the credit channel's utility as a key feature of the monetary policy transmission system. The findings may alter if quarterly statistics are used instead of annual data. Quarterly data capture the short-run impact of policy on loans in a way that annual data does not. Perhaps more study is needed to explore the influence of financial market changes on monetary policy transmission, such as securitization.

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