DETERMINANTS OF PRIVATE SECTOR CREDIT EXTENSION IN SOUTH AFRICA: A DEMAND AND SUPPLY SIDE APPROACH

By

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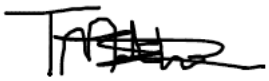

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ABSTRACT

The study examined factors that influence credit extension to the private sector in South Africa between 1990 and 2021. Over the past two decades, South Africa has experienced changes in macroeconomic conditions and regulations. Developments such as the introduction of the National Credit Act of 2005 have had a considerable impact on the extension of private sector credit. The South African Reserve Bank (SARB) ascribed the 2008 sub-prime crisis to the deterioration in private sector credit extension, which led to more stringent lending criteria being imposed on lending institutions. Although several studies on the determinants of private sector credit extension have been conducted in the international community, sub-Saharan Africa, and a few in South Africa, most of the studies analysed the determinants from either the demand or the supply side. It is against this background that this study contributed to literature by examining the determinants of private sector credit extension from the demand and supply sides, using the autoregressive distributed lag (ARDL) bounds testing technique.

The empirical findings of the demand side revealed that inflation and public sector credit are negatively related to private sector credit extension, while property prices and real wage rate were found to be positively related to private sector credit extension in both the long run and short run. Interestingly, the results further revealed that the short-run impact of property prices is seen in its second and third lags, while the impact of real wage rate is seen in its first, second and third lags. Lastly, the impact of public sector credit is only seen in its second lag. The empirical findings of the supply side revealed that gross domestic product (GDP) and bank deposits are positively related to private sector credit extension in both the long run and short run. Therefore, we recommend virtual simulation courses at the tertiary level of education to increase skills and labour productivity, thereby improving real wage rate. We also recommend policy makers formulate policies to enhance the functioning of the economy to foster economic growth. Lastly, we recommend policies to improve financial literacy and inclusion to enhance the deposit taking by banks.

Keywords: autoregressive distributed lag, credit extension, 2008 Financial Crisis, sovereign credit ratings, National Credit Act, COVID-19, private sector, small medium enterprises, South African Reserve Bank, sub-Saharan Africa, South Africa.

DEDICATION

I dedicate this study to my late cousin, Atlas Maluleke, my son, Mohau Mathebula, my nephew, Amukelani Mathebula, and lastly, to my sister, Ntokoto Jafta.

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ACRONYMS

Key Acronyms	Meaning
ABSA	Amalgamated Banks of South Africa
ADF	Augmented Dickey-Fuller
ADRA	Alternative Dispute Resolution Agents
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
AVAR	Asymmetric Vector Autoregressive
BASA	Banking Association South Africa
BBBEE	Broad Based Black Economic Empowerment
BRICS	Brazil, Russia, India, China, and South Africa
CCMB	Continuity Covering Mortgage Bond
CEE	Central and Eastern Europe
CESEE	Central, Eastern and Southeastern Europe
CIPC	Companies Intellectual Property Commission
COVID	Corona Virus Disease
CPD	Corporation for Public Deposits
CLRM	Classical Linear Regression Model
DTI	Department of Trade and Industry
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
FSCA	Finance Sector Conduct Authority
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HQC	Hannan-Quinn Criterion
IDC	Industrial Development Corporation
IPPs	Independent Power Producers
JSE	Johannesburg Stock Exchange
MCEP	Manufacturing Competitiveness Enhancement Programme
MFIs	Micro Finance Institutions

MFRC	Micro Finance Regulatory Council
MFSA	Micro Finance South Africa
MPC	Monetary Policy Committee
MS-ECM	Markov-Switching Error Correction Model
NCA	National Credit Act
NCR	National Credit Regulator
NII	Net Interest Income
NIR	Non-Interest Revenue
NPL	Non-Performing Loan
OECD	Organization for Economic Cooperation and Development
PDA	Payment Distribution Agency
PP	Phillips-Perron
PRP	Property Prices
PSCE	Private Sector Credit Extension
SADC	Southern Africa Development Community
SAFT	South African Future Trust
SARB	South African Reserve Bank
SARS	South African Revenue Services
SBC	Schwarz Bayesian Criterion
SME	Small and Medium Enterprises
SMMEs	Small, Medium and Micro Enterprises
USD	United States Dollar
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VIF	Variance Inflation Factors
WDI	World Development Indicators
WEF	World Economic Forum
WGBI	World Government Bond Index
ZAR	South African Rand

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The analysis of the determinants of private sector credit extension has been a subject of macroeconomic analysis in many parts of the world (see, for example, Bbenkele (2007), Fatoki and Garwe (2012), Kalluci and Shijaku (2013), Imran and Nishat (2013), Damane and Molapo (2017), and Akinsola and Ikhide (2019)). Credit extension performs various important functions to the economy. On a national level, credit extension serves as a vital instrument in the flow of funds by integrating developments between economic policy, aggregate demand, and the overall level of economic activity (Van Der Walt and Prinsloo, 2019). From a firm's perspective, credit is considered as an integral part of ensuring that a firm sustains itself, grows to the desired levels, and ultimately contributes to the economy through taxes and employment creation (Fatoki and Odeyemi, 2010). Similarly, Van Der Walt and Prinsloo (2019) argue that the unrestrictive accessibility of credit makes it easier for firms to establish capital projects, augment stock levels, employ more personnel, and allow businesses to adopt other measures aimed at increasing productivity. From a consumer's perspective, credit extension makes it possible for individuals to make an optimal intertemporal choice. It makes it possible for individuals to spend at present rather than deferring their consumption to a future uncertain date.

Given the important functions performed by credit extension, the determinants of private sector credit have been a subject of many researchers. On a global scope, for example, in one of the pioneer studies, Qayyum (2002) examined the determinants of private sector credit in Pakistan. Later, Hofmann (2004) investigated the determinants of bank loans in 16 industrialised countries. From a supply side perspective, an African study was conducted by Bousrih, Harrabi and Salisu (2007), who examined the impact of debt relief on credit extended to the private sector in 52 African countries. There are also various studies examining this topic in sub-Saharan Africa, such as Akpansung and Babilola (2011), Arsene and Guy-Paulin (2013) and Mallinguh and Zoltan (2018), among others.

In South Africa, the importance of extending credit to the private sector has been highlighted by the Banking Association of South Africa (BASA) which noted that it is vital to finance small

and medium enterprises because of their far-reaching contribution to the economy. In addition, the Department of Trade and Industry (DTI) explained that credit enables the private sector by unlocking various opportunities for South African firms, which comprises among others, economic opportunities in acquiring equipment, machinery, and trading premises. It also benefits South African individuals through the opportunities of education and other consumptions.

Over the past two decades, South Africa has experienced changes in macroeconomic conditions and regulations. Developments such as the introduction of the National Credit Act (NCA) of 2005 have had a considerable impact on the extension of private sector credit. Borrowers felt disadvantaged because more stringent lending criteria were imposed on lending institutions. The 2008 global financial crisis is one of the developments that affected credit extension across the globe. The SARB (2011) pointed out that most emerging markets have been hit hard by the credit crunch of 2007 to 2009 and that South Africa was no exception to the crisis as credit extension has since deteriorated following the global financial crisis. Credit extended by the private sector in South Africa grew by a minimal 10% in 1990, compared to a desirable 26% experienced before the 2008 Financial Crisis. The highest growth rate of credit extension was experienced during healthy economic conditions, while the lowest rates were experienced during tough economic conditions in South Africa. Consequently, it is necessary to investigate the above developments because their impact can be transmitted from either the supply or the demand side or both.

The dissertation is made up of six chapters and it is structured as follows: chapter one introduces the study and describes the problem statement, significance of the study, and research scope. Chapter two discusses the development of private sector credit extension in South Africa, and this includes regulatory developments, impact of the 2008 Financial Crisis, the impact of sovereign credit ratings, and the impact of the COVID-19 pandemic on credit extension. Chapter three discusses theoretical determinants and reviews empirical literature of the determinants of private sector credit extension. Chapter four discusses the methodology to be employed and ends with a description and justification of variables. Chapter five presents and discusses empirical findings for the side, while chapter six concludes the study by proving a summary of the study, a summary of the empirical findings, policy

implications and recommendations, and ends the chapter by discussing limitations and suggests areas for future research.

1.2 PROBLEM STATEMENT

Given the important functions performed by credit extension, the determinants of private sector credit have been a subject of many researchers. On a global scope, there is a bulk of literature focusing on the developed countries (see, for example, Calza et al. (2003), Davis and Zhu (2004), Hoffman (2004), and Temin and Voth (2004)), while others focused on the developing countries (see, for example, Backe, Egert and Zummer (2006), Chakraborty (2006), Karlan and Zinman (2007), and Da Chuna et al. (2020)). There are also various studies examining this topic in sub-Saharan Africa, such as Olokoyo (2011), Mbate (2013) and Adegbenle et al. (2020), among others. However, similar studies in South Africa are scant.

In South Africa, the importance of credit extension has once again been highlighted by BASA (2018), which reported that small and medium enterprises (SMEs) contribute 91% of formalised businesses with 60% of employment contribution to the labour force and total economic activity accounting for approximately 34% of GDP. The banking representative ascribed credit extension to the success of SMEs. Although credit extension plays a crucial role in the South African economy, existing studies in the country did not provide a comprehensive understanding on this topic. In fact, a variety of studies have consolidated with a specific focus on access to credit by SMEs, isolating households as an important feature of the monetary transmission channel (see Bbenkele (2007), Fatoki and Garwe (2012), Chimucheka and Rungani (2013), and Akinsola and Ikhide (2019)). It is against this backdrop that this study seeks to contribute to the existing literature and contribute towards closing the research gap by analysing private sector credit determinants focusing on the demand and supply side perspectives. Specifically, this study examines the private credit determinants in South Africa during 1990Q1 to 2021Q4 by using the ARDL bounds testing approach.

1.3 PURPOSE OF THE STUDY

1.3.1 Aim of the study

The aim of this study is to empirically examine the determinants of private sector credit extension in South Africa.

1.3.2 Objectives of the study

i. To explore the development of private sector credit extension in South Africa during 1990Q1 to 2021Q4

ii. To review the theoretical and empirical literature on private sector credit extension from both demand and supply side perspectives

iii. To ascertain the long-run and short-run relationship between private sector credit and its determinants (Gross domestic product, interest rates, inflation, real effective exchange rate, property prices, real wage rate and public sector credit) in South Africa from a demand perspective during 1990Q1 to 2021Q4

iv. To ascertain the long-run and short-run relationship between private sector credit and its determinants (Gross domestic product, property prices, interest rates, bank deposits and government deficit) in South Africa from a supply perspective during 1990Q1 to 2021Q4

1.4 HYPOTHESES

In respect of the objectives above, the following hypotheses are formulated based on theoretical and empirical literature on how each variable affects credit extension:

Credit extension determinants (demand side hypotheses):

(i) GDP is positively related to private sector credit extension

(ii) Interest rate is negatively related to private sector credit extension

(iii) Inflation is negatively related to private sector credit extension

(iv) Exchange rate is negatively related to private sector credit extension

(v) Property prices is positively related to private sector credit extension

(vi) Real wage rate is positively related to private sector credit extension

(vii) Public sector credit is negatively related to private sector credit extension

Credit extension determinants (supply side hypotheses):

(i) GDP is positively related to private sector credit extension

(ii) Property price is positively related to private sector credit extension

(iii) Interest rate is positively related to private sector credit extension

(iv) Bank deposit is positively related to private sector credit extension

(v) Government deficit is negatively related to private sector credit extension

1.5 SIGNIFICANCE OF THE STUDY

The examination of the determinants of private sector credit extension: a demand and supply side approach in South Africa complements the literature in several ways. Firstly, although similar topics such as the analysis of bank credit and access to credit by SMEs have been documented in South Africa by employing qualitative research design methods, this study uses a unique approach by analysing the determinants and private sector credit extension in a comprehensive manner. Previous studies conducted by researchers – such as Clarke and Cull (2006), Bbenkele (2007), Okurut (2010) and Chimucheka and Rungani (2013) – focused on qualitative methods (surveys) and only analysed qualitative variables – such as age, race, collateral, level of education, country risk and information asymmetries – to study the determinants of credit and ignored most macro and micro economic quantitative determinants on their studies. This study is intended to complement this topic and address the drawback by analysing the determinants of private sector credit extension through quantitative methods, covering both households and business enterprises.

Secondly, although several studies on the determinants of private sector credit extension have been conducted in the international community and sub-Saharan Africa, and very few in South Africa, most of the studies analysed the determinants from one side of the economy – either the demand or the supply side. Studies that included both the demand and supply side variables did not employ a regression for each side, but rather, included the variables in one model, which may prove to be distortionary and produce inconclusive results. The only authors reviewed in this study, who employed a separate model for the demand and supply side, are Kalluci and Shijaku (2013). They employed the Vector Error Correction Model (VECM) to analyse determinants of private sector credit in Alabama. In sub-Saharan Africa (including South Africa), no study in South Africa has analysed the determinants from both the demand and supply sides with separate models being used for each side. Authors such as Ahmed and Cheng (2014), Crocco (2014) and Temesgen (2016) did not specify which side they were analysing. This study contributes towards addressing this shortfall by analysing the

determinants from the demand and supply perspective, using a separate regression model for each side.

Thirdly, various researchers have produced contradictory empirical results on the determinants of private sector credit extension. For instance, Akinlo and Oni (2015), and Katsusiime (2018) found inflation to be positively related to credit extension, while Mallinguh and Zoltan (2018) and Adegbenle et al. (2020) found inflation to be negatively related to credit extension. This may be a result of most studies singling out bank credit instead of considering credit extended by all monetary institutions and singling out SMEs from the private sector, which includes businesses and households. This study brings a unique (if not new, in South Africa) approach by considering credit extended by all formal monetary institutions and by considering the entire private sector of South Africa instead of focusing on small businesses only.

Lastly, the study brings a unique approach to the examination of the determinants of private sector credit extension, through the ARDL, which is known for its ability to investigate both the long run and short run relationships, unlike traditional models such as the Granger and Engle cointegration (1987) and Johansen Cointegration (1988, 1991, 1995) as argued by Pesaran and Shin (1997). Although some researchers such as Assefa (2014) and Damane and Molapo (2017) have employed this model in sub-Saharan Africa, the only researchers who employed the ARDL in South Africa are Muzinduti and Nhlapho (2017), who focused on the effect of credit risk (a supply side study) on credit extension. This study employs the ARDL to analyse the determinants from the demand and supply side, and further adds to the body of knowledge by including lags to fully understand the impact of the determinants in the short run.

1.6 RESEARCH SCOPE

The focus of the study is South Africa and in particular, the study investigates credit extension activities of the South African private sector, which is made up of firms and households. The study covers the period from 1990 to 2021. The study reviews similar studies across the globe, sub-Saharan Africa and South Africa, and employs micro and macro-economic data to empirically examine the determinants of private sector credit extension.

1.7 CONCLUSION

This chapter focused on introducing the study and this was done by providing background and a problem statement, which prompted the need to conduct this study. The study then described the purpose of the study by outlining the aim and objectives of the study. In addition, the chapter formulated hypotheses, described the significance of the study, and ended with describing the scope of the study.

CHAPTER 2: THE DEVELOPMENT OF PRIVATE SECTOR CREDIT EXTENSION IN SOUTH AFRICA

2.1 INTRODUCTION

The importance of credit extension in an economy plays a similar role for both governments and the private sector (households and firms). Credit extension is a vehicle used to bridge the gap between current expenditure, production needs and future income. Governments bridge their expenditure by borrowing from local and international markets. Similarly, households and firms rely on credit to fund and finance their consumption and production needs respectively, and this is mostly realised through credit extension. This chapter focuses on sharing some background on factors that constitute, drive, and encompass private sector credit extension in South Africa as it is identified as a necessary vehicle of the monetary transmission mechanism.

The chapter begins with a view on the structure of the South African financial services sector through discussing macro and micro credit institutions, then proceeds to discuss regulatory developments and regulatory bodies. This is followed by unpacking the developments, which includes a view on the economic consequences of the 2008 global financial crisis, credit ratings' impact on credit extension and lastly, COVID-19's impact on credit extension. The researcher concludes the chapter by discussing the challenges faced by borrowers and lenders in South Africa.

2.2 STRUCTURE OF THE SOUTH AFRICAN FINANCIAL SERVICES SECTOR

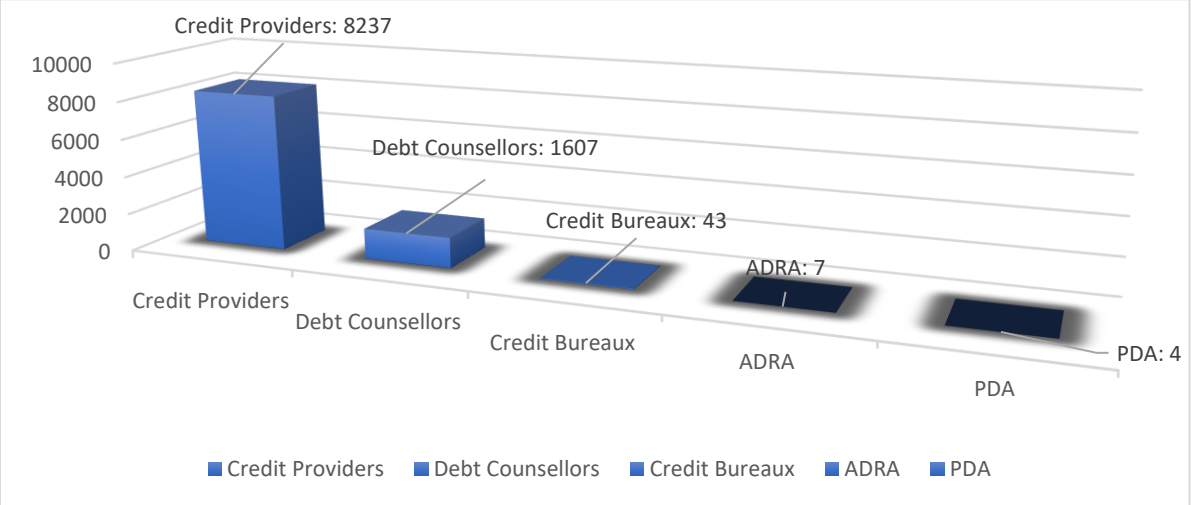
South Africa is reported to be one of the countries with a sophisticated and highly regulated financial services sector in the African continent and in the world. In its annual global competitiveness report in 2019, the Word Economic Forum (WEF) ranked South Africa as number 60 out of 141 countries world-wide and number 19 out of 20 countries, as a financial hub. The WEF attributed these ratings to the country's effective, stable, and well-regulated banking system (WEF, 2019). The composition of South Africa's financial services sector is made up of two sub-sectors, namely, the macro finance and micro finance sectors. The macro finance sector comprises commercial banks, development banks, mutual banks, and other credit providers. Micro finance consists of small credit providers such as Letsatsi Finance and

Business Partners. The micro finance sector was instituted in 1992 when the state granted an exemption to the Usury Act on interest rate ceilings (Daniels, 2004).

The macro credit providers are regulated by the National Credit Regulator (NCR), the Financial Sector Conduct Authority (FSCA), the Companies Act, the Financial Sector Regulatory Bill and other various applicable regulators. Meanwhile, the micro finance sector is regulated by the Micro Finance Regulatory Council (MFRC), which was established to manage this sector following the growth that was realised after the exemption to the Usury Act. The micro finance sector is also regulated by the National Credit Act No.34 of 2005.

Figure 2.1 provides a view of the key role players of private sector credit extension. All role players depicted in figure 2.1 are registered and regulated by the NCR.

Figure 2.1 Role players of credit extension in South Africa in 2021



Source: Own compilation based on data from the National Credit Regulator 2021.

Notes: ADRA stands for alternative dispute resolution agents and PDA stands for payment distribution agents.

As shown in figure 2.1, there are over 8 237 registered credit providers in South Africa and 43 credit bureaux, 1 607 debt counsellors, 7 alternative dispute resolution agents and 4 payment distribution agents, as at 31 March 2021 (NCR, 2021). The number of credit providers includes both macro and micro credit providers. Although all registered with the NCR, some of them are new and are yet to participate in credit extension (NCR, 2021). Credit bureaus are responsible for collecting and storing credit records of businesses and individuals and are mainly used by credit providers as one of the tools that provide the payment history of

borrowers. A payment history helps credit providers to confirm whether a borrower is a bad payer. Debt counsellors are responsible for assisting struggling borrows with rehabilitation of debts, while alternative dispute resolution agents provide an alternative to court proceedings and assist mainly with mediation, conciliation and arbitration relating to credit matters. Lastly, payment distribution agents are responsible for collecting funds from consumers who are under debt counselling and paying over the funds to the relevant credit provider (NCR, 2021).

2.2.1 Macro finance institutions

At the forefront of banking regulation, supervision and registration is the SARB. The SARB was founded in 1921 as part of the responses that the country implemented following the economic turmoil brought about by World War I, which took place between 1914 and 1918 (SARB, 2021). Famously known as the oldest Reserve Bank in Africa, the formation of the lender of last resort (SARB) was a post-World War I response, due to the challenges that the South African Reserve Bank had with backing currency or bank notes, using gold. During the period of the First World War, prices of mineral resources – such as gold held in the United Kingdom – revolted against the prices of gold in South Africa. Consequently, this led to South African dealers of gold converting bank notes into gold and selling the gold in the United Kingdom to make profits (SARB, 2021). This conundrum led to banks having to import expensive gold from the United Kingdom to back bank notes in issue. Furthermore, a conference was held in 1919 following a recommendation by commercial banks that the conversion of bank notes to gold be removed as it was no longer viable for their business. The recommendations that were made during the 1919 conference led to the establishment of the SARB.

At that point, the SARB was mandated with the issuance of bank notes and holding the gold that was held by commercial banks. The SARB then, had two main objectives, namely, to reinstate and maintain order in issuing and circulating domestic currency, and to restore South Africa's gold standard to the pre-World War I rate of exchange. The Currency and Banking Act No. 31 of 1920 was replaced by the South African Reserve Bank Act of 1944 and this led to the subsequent extension of the central bank's issuance of bank notes perpetually. South Africa abandoned the gold standard in 1932 and at that time, the country chose to synchronise the value of the local currency to the pound sterling as the country's new monetary policy framework. A few years later, the country introduced the rand (on 14

February 1961) and this was done 90 days before the country left the Commonwealth to become an independent republic. Subsequently, the SARB Act of 1944 was replaced by the SARB Act of 1989, which led to the Reserve Bank reaffirming its mission statement: to safeguard the internal and external value of the South African rand.

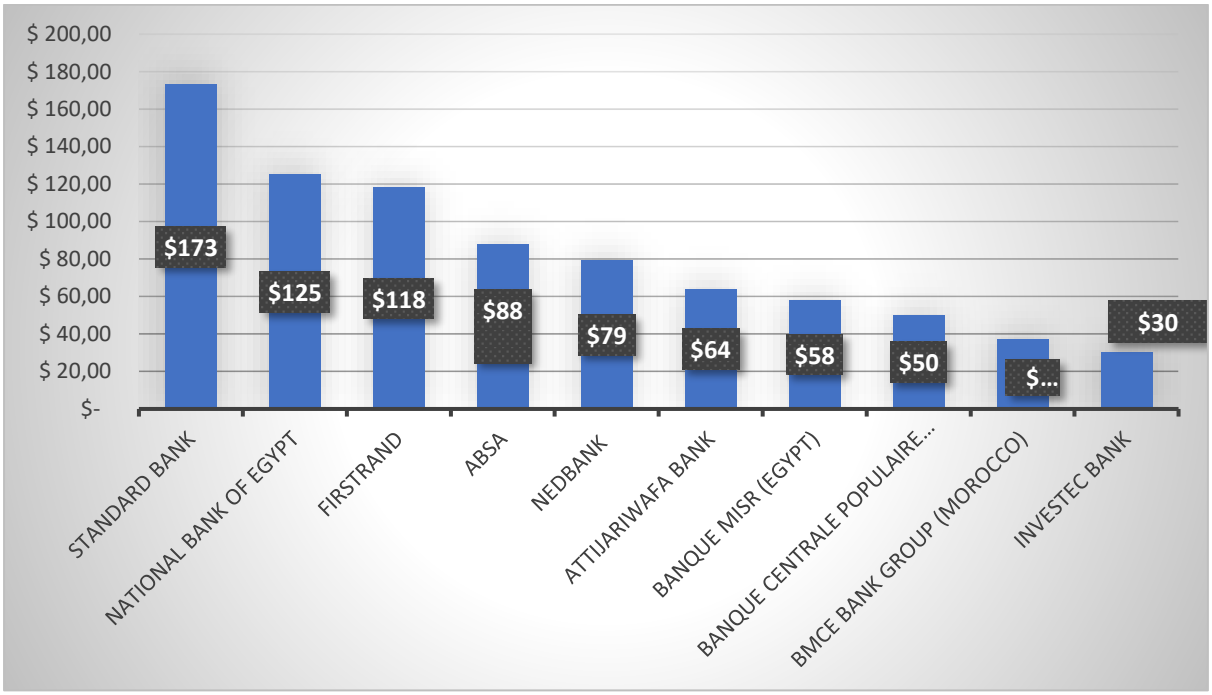
For the period 2000-2004, the objective of the SARB was to achieve and maintain financial stability, which was later changed to the achievement and maintenance of price stability. South Africa adopted the inflation targeting framework in 2000, which mandated the SARB to target and maintain inflation at a rate not less than 3% and not more than 6%. The inflation targeting framework is the responsibility of the monetary committee of the bank, which usually meets five times a year (March, May, July, September, and November) to decide on the repurchase rate (commonly known as the repo rate). This in turn determines the prime lending rate. The repurchase rate is the rate charged by the Reserve Bank to retail or commercial banks for borrowing funds and the prime overdraft rate is the base lending rate charged by commercial banks to its prime (credit worthy) customers.

The monetary policy committee (MPC) is made up of seven members, which includes the governor, three deputy governors and three other senior officials nominated by the governor. This committee is responsible for setting and announcing interest rates in the country; this is the primary tool of maintaining price stability. In 1985, South Africa was put on sanctions by its trading partners, due to the way the apartheid government ran the country. This led to government introducing foreign exchange controls due to the outflows resulting from debt defaults, which stemmed from the restrictive sanctions imposed on the country. The exchange control measures were introduced with a dual rand system, which dictated that there must be a separate exchange rate for current account payments for the country's residents, and a different rate for capital amount payments applicable to non-residents.

One of the notable responsive measures adopted by the MPC during the 2008 global financial crisis was the reduction of the repo rate by 650 basis points between November 2008 and November 2010. Lastly, the SARB has a subsidiary named the Corporation for Public Deposits (CPD). This corporation was established in 1984 and is regulated by the Corporation for Public Deposits Act No. 46 of 1984. The CPD is responsible for the acceptance of deposits from the public sector and may, with permission of the minister of finance, accept deposits from depositors other than the public sector.

The purpose of the previous section was to provide a detailed view of the SARB as the registrar of banks. The function of the SARB is necessary as it regulates and oversee banks, which are regarded as the main credit providers to the private sector. The study proceeds to provide a breakdown of Africa's top ten banks by assets (in United States dollars). This view is necessary for the study as asset size comprises fixed property, investments, intangible assets and loans and advance. An expansion in loans and advances is a result of an increase in credit extension and has a great impact on the total asset size of a credit provider. A continental view is provided to give a view of how South African banks compare to other banks in the African continent by asset sizes.

Figure 2.2 Africa's ten largest banks by assets (in USD billion) in 2021

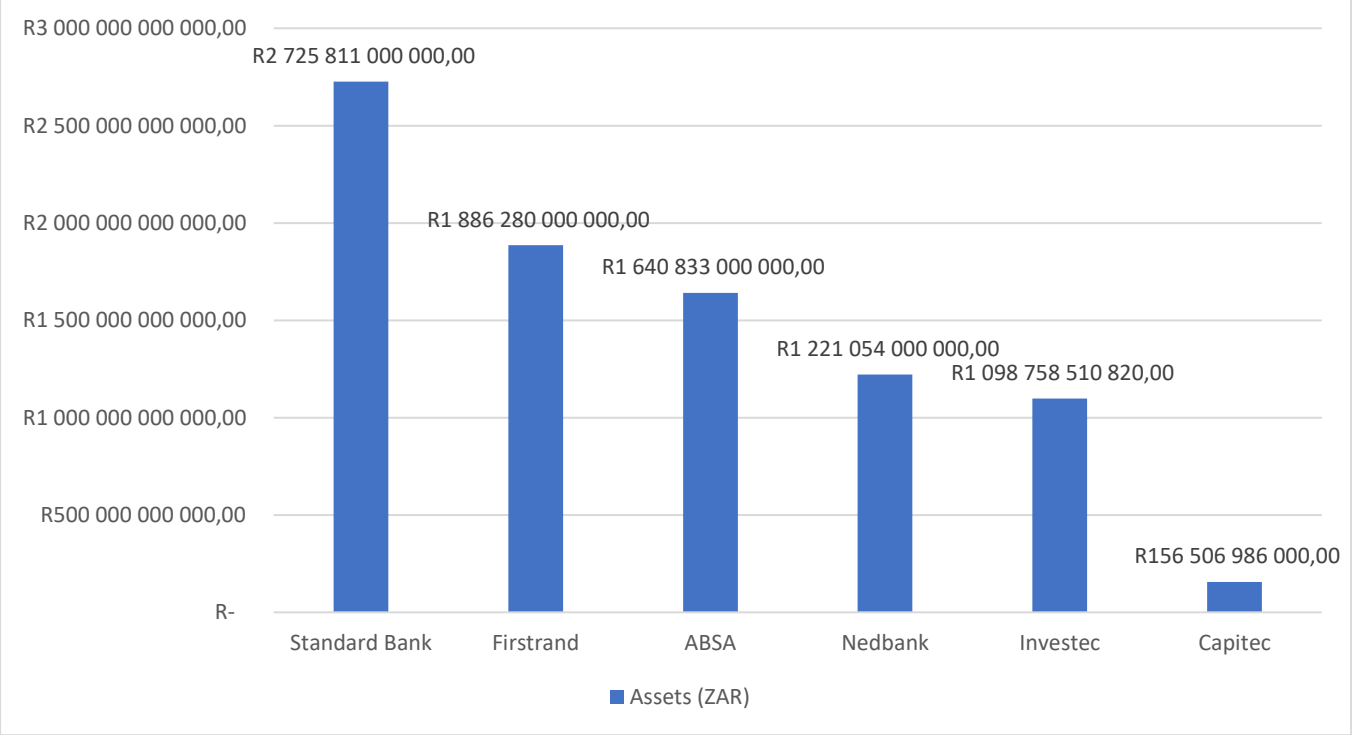


Source: Own compilation based on data from Statista.com, 2021.

Figure 2.2 reveals that four of South Africa's top banks by asset size are featured in the top five in the continent, while one of them is the tenth largest bank by assets in the African continent. The researcher has analysed the financial statements of all five South African banks, and it was discovered that loans and advances are the biggest contributor to the assets of the five South African banks featured in the top ten African banks by assets. From a policy perspective, understanding what determines credit extension will help credit providers understand how they can increase their asset size while mitigating credit risk.

Figure 2.2 provided a view of Africa's big banks by assets. The next figure (figure 2.3) provides a view of South Africa's biggest six banks by assets (ZAR trillion). Five of the banks were featured in Africa's top ten banks by assets, except Capitec Bank. Figure 2.3 differs from figure 2.2 in that the currency used in figure 2.3 is the South African rand (ZAR), while figure 2.2 used United States dollars; also, figure 2.2 focused on the continent, while figure 2.3 focuses on South Africa as the scope of the study.

Figure 2.3 Top six South African banks by assets (ZAR trillion)



Source: Own compilation based on 2021 annual financial statements of all six banks.

As depicted in both figure 2.2 and figure 2.3, the five biggest banks of South Africa have assets of more than a trillion, except Capitec with only R156 billion and, although small, the fastest growing bank has one of the largest customer bases and competes with the traditional big five in terms of Johannesburg Stock Exchange (JSE) market capitalisation. Like the traditional five banks, the biggest contributor to Capitec's asset size is loans and advances.

The following table provides a five-year view of loans and advances for the six biggest banks of South Africa. The table serves to provide a view of how credit extension has improved or contracted within the past five years, for the main providers of credit in South Africa.

Table 2.1 Top six banks view of loans and advances from 2017 to 2021

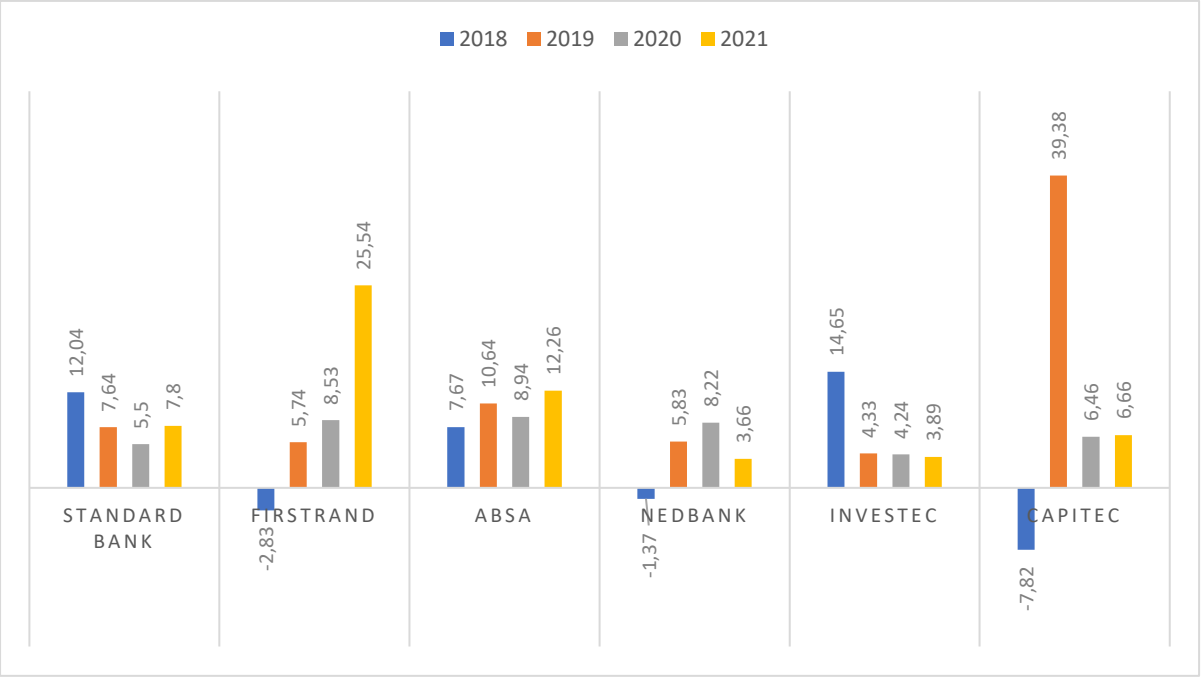
Name of Financial Institution	Year End of Institution	Loans and Advances	Loans and Advances	Loans and Advances	Loans and Advances	Loans and Advances
		Year	Year	Year	Year	Year
		2017	2018	2019	2020	2021
Standard Bank	31 Dec	R1 038 555 000 000	R1 119 547 000 000	R1 181 067 000 000	R1 271 255 000 000	R1 424 328 000 000
FirstRand	30 June	R910 066 000 000	R1 142 476 000 000	R1 239 914 000 000	R1 311 095 000 000	R1 274 052 000 000
ABSA	31 Dec	R749 772 000 000	R841 720 000 000	R916 978 000 000	R1 014 517 000 000	R1 092 257 000 000
Nedbank	31 Dec	R710 329 000 000	R736 305 000 000	R796 833 000 000	R843 303 000 000	R831 735 000 000
Investec	31 March	R408 739 339 500	R424 622 484 890	R442 606 944 120	R461 764 029 720	R529 415 298 710
Capitec	28/9 Feb	R39 204 980 000	R41 814 395 000	R44 514 694 000	R62 043 072 000	R57 188 755 000

Source: Own compilation based on data from the annual financial statements of each bank (2017, 2018, 2019, 2020 & 2021).

As shown in table 2.1 above, the Standard Bank of South Africa Limited is the biggest bank by loans and advances in South Africa, with R1.4 trillion as at 31 December 2021. The table reflects that Standard Bank, Amalgamated Banks of South Africa (ABSA) and Investec have seen a continuous increase in loans and advances from 2017 to 2021, while FirstRand, Nedbank and Capitec have seen an increase in loans and advances from 2017 to 2020, accompanied by a decrease in loans and advances from 2020 to 2021 for all three banks. The knock-on effect of a decrease in loans and advances is a corresponding decrease in total assets of each financial institution.

The following figure reflects annual percentage change of loans and advances for the six largest banks of South Africa. The percentage changes have been derived from figures in table 2.1 and represent the annual percentage growth or contraction in credit extension. The purpose of figure 2.4 is to provide a view of the growth rate of credit extension of each bank compared to its peers.

Figure 2.4 Percentage change in loans and advances from 2018 to 2021



Source: Own compilation based on the annual financial statements of each bank (2021, 2020, 2019 & 2018).

According to figure 2.4, South Africa's top six banks are so strong in assets that they form part of the top ten African banks by assets. Their asset size reflects the extent to which they extend credit, as loans and advances are the biggest contributor to their total assets. Capitec and FirstRand are the only credit providers with a yearly percentage growth rate of loans and advances over 20%, with Capitec having grown by 39,38% in 2020 and FirstRand having grown by 25,54% in 2018. Conversely, Capitec, FirstRand and Nedbank are the only credit providers with a negative percentage rate, with Capitec having the biggest contraction of -7,82% in 2021, followed by FirstRand, which contracted by 2,83% in 2021, and Nedbank contracting by 1,37% in 2021. The other lenders have been growing with a positive rate from 2017 and during the COVID-19 phase, which saw their counterparts contracting on loans and advances.

The above analysis is complemented by the SARB's Prudential Authority 2021 annual report, which revealed that the banking sector has total assets of R6 456 662 000 000 as at 31 March 2021 – down from R6 579 000 000 000 in the previous financial period; this decrease was attributed to a decline in derivative financial instruments and loans (SARB, 2021). The regulator further revealed that the five largest banks control 90,1% of total banking industry assets – up from 89,4% in the previous financial period (31 March 2020). The annual report

also revealed that local branches of foreign owned banks controlled 5,9% as at 31 March 2021 – down from 7%, which was reported on 31 March 2020 – and other banks (mutual and cooperative banks) controlled 4% of total banking industry assets during the same period. This represented an increase from 3,69% reported in the previous period (31 March 2020). Lastly, the Prudential Authority report revealed that the combined loans and advances represented 71,25% of total banking assets; this gives a clear indication that the main business of banking institutions is generated through credit extension (SARB, 2021).

The researcher has thoroughly analysed the financial statements of all six banks, with the intention of understanding the core income generators of each bank and the main contributors of the banks' total assets. The figures provided in the following section were extracted from the audited annual financial statements of the six largest banks of South Africa.

i. Standard Bank Group

Standard Bank is the biggest bank in Africa and in South Africa by assets. The lender finished the 2021 financial period with total assets of R2.7 trillion. This was an increase from R2.5 trillion in the previous financial period (2020). The biggest contributor to Africa's largest lender by assets, is loans and advances. The bank's income is split between net interest income (NII), which is income generated from lending activities, and non-interest revenue (NIR), which is income generated from other fees except lending. An example of NIR is monthly bank fees (Standard Bank, 2021). As at 31 December 2021, the Standard Bank Group reported an income of R114 billion, which is made up of NII R62 billion and NIR R51 billion. This suggests that credit extension is the main income generator for the largest bank in Africa (Standard Bank, 2021).

ii. FirstRand Group

FirstRand Bank is the third biggest bank in Africa, as at 30 June 2021, and the second biggest bank in South Africa in the same category. The lender finished the 2021 financial period with total assets of R1.886 trillion – down from R1.926 trillion in the previous financial period (2020). The bank reported total income of R85 billion as at 30 June 2021, and its income is also split between NII R47 billion and NIR R38 billion (FirstRand, 2021).

iii. ABSA Group

ABSA is the fourth largest bank in Africa by assets as at 31 December 2021, and the third biggest bank in South Africa, in the same category. ABSA ended the 2021 financial period with total assets of R1.6 trillion – an increase from R1.5 trillion in the previous financial period (2020). Like its leading counterparts, its biggest contributor to total assets is loans and advances. The bank reported total income of R85 billion as at 31 December 2021. The income is made up of NII R53 billion and NIR R32 billion – this also implies that South Africa's third largest bank by assets generate most of its income from credit extension (ABSA, 2021)

iv. Nedbank Group

Nedbank is the fifth biggest bank by assets in Africa and the fourth biggest in South Africa in the same category. The group finished the 2021 financial period with total assets of R1.221 trillion – down from R1.228 trillion in the previous financial period (2020). Loans and advances also represent the biggest contributor to total assets. The banking group reported total revenue of R57,5 billion as at 31 December 2021; its income is made up of NII R 32,5 billion and NIR R25 billion, with NII being the biggest contributor to income (Nedbank, 2021)

v. Investec

Known for its niche offering, Investec is the tenth biggest bank by assets in Africa and the fifth biggest bank by assets in South Africa. The investment bank ended the March 2021 financial period with total assets of R1.098 trillion – up from R949 billion in the previous financial period (2020) (Investec, 2021).

vi. Capitec Bank

Capitec is generally not included in the biggest banks by assets in both Africa and South Africa, however, its market capitalisation and huge customer base competes with the traditional biggest banks of the country. The fastest growing bank reported total assets of R156 billion as at 28 February 2021, up from R134 billion reported in the previous financial period (2020). Loans and advances also representing the biggest contributor to total assets (Capitec, 2021).

2.2.2 Micro finance institutions

Micro Finance South Africa (MFSA) is a representative body of registered micro finance credit providers established in 1996 in South Africa. MFSA represents about 1 300 micro finance

credit providers that are also registered with the NCR (MFSA, 2021). MFSA is like the BASA, and their representations are differentiated by the sizes of the institutions they represent.

The micro financing industry of South Africa is regulated by the MFRC, which was introduced on 16 July 1999 and was established in conjunction with the DTI. The council is responsible for the registration of micro lenders, enforcement of compliance with the regulatory council, and for providing education to consumers in the micro finance industry. The establishment of the council is a result of lack of access to credit facilities through traditional lending institutions such as banks. The purpose of the regulatory council was to formalise micro lending activities, to create a regulatory framework, and to ensure that all micro lending activities are consistent and uniform. In addition, its scope included increasing the limit of credit facilities from R6 000 to R10 000 and to eliminate abusive lending practices where micro lenders charge punitive interest rates to borrowers (MFRC, 2000).

The micro finance industry plays a pivotal role in the South African credit industry; it was reported to be made up of 8 000 micro lenders and had extended loans of up to R15 billion during early 2000. The introduction of the NCA saw the landscape changing as all credit providers were required to be registered with the NCR from 2006, going forward (MFRC, 2000). The micro lending industry was deregulated in 1992 and its deregulation came with an exemption of loans not exceeding R6 000, from the Usury Act. Precedent to the adoption of the MFRC and NCA, the Usury Act was the main Act responsible for the regulation of lending activities in South Africa (MFRC, 2000). The establishment of the MFRC resulted in a few changes, including the credit ceiling increasing from R6 000 to R10 000, maximum interest rates to be charged capped at ten times the prime lending rate, a new requirement of full disclosure of terms and conditions, the maintenance of confidential borrower information, and the prohibition of lenders seizing borrower bank cards and obtaining pin numbers of those bank cards (MFRC, 2000).

The previous section discussed some major credit providers of South Africa as noted by both the SARB and the NCR. The SARB (2021) reported that the top five banks of the country hold over 90% of total baking assets, while the NCR (2021) reported that banks grant over 75% in new credit extended on a quarterly basis. The basis of the following section is to provide a view on micro credit providers as the other important role player of credit extension in South Africa.

i. Pollen Finance

Pollen Finance is a recent micro financial institution located in Stellenbosch, in South Africa, which was established in 2015 with a focus on the extension of business loans. The institution is backed by the Anglo African Group, which is also a financial services firm with a focus on extending credit to small, medium, and micro enterprises (SMMEs). Pollen has a loan threshold of R6 million to a single borrower and a maximum repayment period of eight months subject to their lending terms and conditions. The lender has reportedly extended approximately R3 billion to SMMEs since its establishment (Pollen Finance, 2021).

ii. The RCS Group

RCS is a formal credit and financial services provider under the BNP Paribus umbrella and is recognised as one of the emerging lending micro finance houses in South Africa. The credit provider offers store cards and personal loans of up to R150 000. In 2019, the company announced that it is expanding its offering to include secured lending such as home loans and vehicle and asset finance. This is a strategic move aimed at gaining market share and ultimately increasing revenue and profitability (The RCS Group, 2021).

iii. Business Partners

Business Partners is a well-known financial services provider with a strong presence in South Africa, Kenya, Malawi, Namibia, Rwanda, Uganda, and Zambia. The institution was established to cater for SMEs' finance/funding needs. The credit provider offers loans from R500 000 to R50 million to formalised businesses. Some of its solutions are enterprise finance, commercial property finance, property joint venture finance and green buildings finance. It is reported that the credit provider has extended business loans of approximately R20 billion from establishment to date (Business Partners, 2021).

iv. Letsatsi Finance

Letsatsi Finance is one of the leading micro finance institutions and a well-known player operating in all nine provinces in South Africa. The financial services provider offers various types of loans ranging from one-month loans – where a borrower can borrow from as little as R500 to a maximum of R7 000, and short-term loans that are extended for a period of 2-6 months; this loan is also restricted to between R500 and R7 000. Lastly, the credit provider

also offers long-term loans, starting from 7 months, 9 months and up to 13 months' term. These types of loans start from as little as R1 000 to a maximum of R50 000 (Letsatsi Finance, 2021).

2.3 REGULATORY DEVELOPMENT

The BASA represents all banks in South Africa. Its representation spans various aspects such as submissions to parliamentary committees, on banking related matters such as debt intervention regulations and other matters that the banking industry wishes to communicate as an industry (BASA, 2021). The Reserve Bank of South Africa also plays a critical regulatory role in the demand and supply of credit through its control of the cost of credit, as its monetary policy is responsible for setting base interest rates (SARB, 2021); the minister of the DTI is also responsible for setting interest rate ceilings (South Africa's Department of Trade and Industry, 2015).

The SARB (2004) posits that excessive lending to the corporate sector can contribute to a financial crisis; the impact is believed to be a consequence of an increase in non-factoring of loans. The SARB holds that while banks are more exposed to corporate lending than they are to household lending, the impact of excessive household credit extension can be argued to have a similar impact on financial stability or instability. The Financial Stability Review Committee is a regulatory arm of the South African Reserve Bank, which was established in 1999 to oversee the stability and instability of the financial sector. The purpose of the financial sector committee is to enhance financial stability, which it does by continuously assessing the stability and efficiency of the financial system. It formulates and reviews policy intention and crisis resolution that may occur in the financial sector (SARB, 2004). The financial stability committee oversees the entire financial services sector, including but not limited to banking, micro finance institutions, and the insurance sector, which may be due to ownership structures and investment linkages (SARB, 2004). This is done to ensure that any instability that may occur in other sectors may have spill over effects on the banking sector.

In conclusion, BASA (2018) believes that there have been numerous developments in the credit regulatory environment, which included, among others, more stringent affordability criteria being introduced by the Minister of Trade and Industry in September 2015, and the limitation of fees and interest rates as prescribed by the Minister of Trade and Industry. Both

these changes have resulted in less credit being granted and extended to low-income consumers.

2.3.1 Regulations on credit extension

South Africa's financial sector is regulated by various regulators such as the Banks Act of 1990 and the Mutual Banks Act of 1993. The South African Reserve Bank, as the register of banks, is responsible for, among many other duties, registration of all new banks in South Africa (SARB, 2021). The other part of the financial sector, which is referred to as the non-banking sector, is regulated by the FSCA. The FSCA is responsible for overseeing the activities of various institutions such as insurance companies, fund managers, brokerage institutions and the JSE (JSE, 2021). Lastly, the NCR is the regulatory body of the South African credit industry with certain juristic entities being excluded due to size of assets and turnover. The NCR is mainly responsible for the registration of all formal credit providers (macro and micro), credit bureaus and debt counsellors – and further enforces compliance to its regulations through the National Credit Act No. 34 of 2005 (NCA, 2006).

2.3.2 Regulatory bodies

This sub-section follows a historical trend to give a view of regulations that have been governing credit extension from 1968 (with the Usury Act), to date (with the National Amendment Credit Act of 2019).

i. The Usury Act No. 73 of 1968

Usury is defined as the act of extending credit at highly unreasonable terms and condition, such as punitive interest rates. The Usury Act No. 73 of 1968 came into effect on 1 April 1968; its purpose was to regulate interest charges for credit transactions above R6 000 and required the disclosure of finance charges to the borrower, in writing. The scope of the Act covered money lending transactions and lease transactions. The Usury Act No. 73 of 1968 was assented on 20 June 1968 and was established to regulate the limitation and disclosure of finance charges levied in respect of credit and leasing transactions. The scope of the Act also regulated the interest rates charged by lenders and made a provision for maximum interest rates that can be charged in credit and leasing transactions, and was adopted to repeal the Usury Act, 1926 (South Africa. Usury Act 73 of 1968).

The Act was later modified by the Limitation and Disclosure of Finance Charges Amendment Act No. 76 of 1970, Limitation and Disclosure of Finance Charges Amendment Act No. 62 of 1974, Limitation and Disclosure of Finance Charges Amendment Act No. 90 of 1980, Limitation and Disclosure of Finance Charges Amendment Act No. 42 of 1986, Usury Amendment Act No. 62 of 1987, Usury Amendment Act No. 100 of 1988, Usury Amendment Act No. 91 of 1989, and the Usury Amendment Act No. 1 of 2000. According to the South African Usury Act (1968:15), ''no moneylender shall in connection with any money lending transaction stipulate for, demand, or receive finance charges at an annual finance charge rate greater than the percentage determined by the Registrar by notice in the Gazette in accordance with the directions of the Minister''.

The Usury Act further allows that, if the total amount of money lent by a moneylender to a borrower within any period of three months, including disbursements made by him within said period and recoverable as part of the principal debt, is different, various percentages may be determined under paragraph (a) for money lending transactions. In addition, requires that no lessor shall, in connection with any leasing transaction, stipulate for, demand, or receive finance charges at an annual finance charge rate greater than the percentage determined by the Registrar by notice in the Gazette in accordance with the directions of the Minister, as determined by the law.

ii. Credit Agreement Act 9 of 1985

The Credit Agreement Act No.75 of 1980 was assented on 4 June 1980, became effective on 2 March 1981, and repealed the Hire Purchase Act 36 of 1942, Hire Purchase Amendment Act 46 of 1954, Hire Purchase Amendment Act 14 of 1957, Hire Purchase Amendment Act 50 of 1959, Hire Purchase Amendment Act 30 of 1965, Hire Purchase Amendment Act 79 of 1970, and Hire Purchase Amendment Act 73 of 1972. The Credit Agreement Act was rather ineffective and had limited scope in that it regulated certain credit transactions, which included movable goods purchased or leased on credit and any other transactions including services rendered on credit. The Credit Agreement Act No. 75 of 1980 was later amended by the Credit Agreement Amendment Act No. 9 of 1985, which extended the powers granted to the minister. This allowed the minister to prohibit certain credit related advertisements, and allowed a credit provider to collect certain goods in the possession of a borrower when the

borrower terminates a valid credit agreement. The amended regulation also makes provision for a limitation on credit where an administration order has been obtained.

Lastly, the amended regulation extended the scope of the Act to allow inspectors to inspect the credit amendments held by credit providers without the authorisation or permission of the finance minister. This is a milestone as the initial Act did not provide for these inspections and prevented transparency between the credit provider and borrower.

iii. The National Credit Act 34 of 2005

The National Credit Act No. 34 of 2005 came into effect on 10 March 2006, after the former President of South Africa (Thabo Mbeki) assented the Act into law. The NCA was enacted because of a need for a comprehensive credit regulatory framework in the credit industry aimed at protecting both lenders and borrower's rights in a manner that benefits both and, consequently, the economy of South Africa. The National Credit Act applies to all natural persons in South Africa and juristic bodies with an annual turnover of not more than R1 million or a monetary asset value of not more than R1 million (NCA, 2005: Section 7 (1)). Credit agreements involving juristic persons with an annual or asset value of more than R1 million are covered by the Companies Act and the Reserve Bank Act, and any disputes or proceedings between a creditor provider and a borrower not covered by the NCA are referred to the relevant courts.

The NCA was introduced to repeal the Usury Act No. 73 of 1968, the Credit Agreements Act No. 75 of 1980 and the Integration of Usury Laws Act No. 57 of 1996, and to augment the existing pieces of legislature by extending the scope of credit law and regulation. The DTI argues that there was an imbalance that existed between borrowers and lenders, stemming from issues such as low financial literacy, which has prompted over indebtedness and weak disclosures by lenders. The laws that previously regulated credit in South Africa were not extensive and did not cover a holistic view of the credit industry. The enactment of the NCA led to most of these laws being repealed and any credit agreement entered post 10 March 2006 was covered under the NCA. Section 3 of the NCA details the purpose of the Act as ''to promote and advance the social and economic welfare of South Africans, to promote a fair, transparent, competitive, sustainable, responsible, efficient, effective, and accessible credit market and industry'' (South Africa. National Credit Act 34 of 2005: 30).

iv. Companies Act 71 of 2008

The statute repeals the Companies Act No. 61 of 1973 and makes amendments to the Close Corporation Act No. 69 of 1984. The private sector involves firms and households and where firms are concerned, the Companies Act comes into effect for both private and public companies. Section 4 of the Companies Act No 71 of 2008, sub-section (1) (a) defines solvency as a situation where ‘‘the assets of a company or if the company is a member of a group of companies, the consolidated assets of the company, valued, must be equal or exceed the liabilities of the company or if the company is a member of a group of companies, the consolidated liabilities of the company as fairly valued’’ (South Africa. Companies Act 71 of 2008: 36). Section (22), sub-section (1) prohibits reckless trading and prohibits a company from carrying on its business in a reckless manner, with gross negligence, with intent to defraud any person, or for any fraudulent purpose or trade under insolvent circumstances.

As a result of the above definition of solvency and prohibition contemplated in section (22), sub-section (1), financial institutions interpret the Act as that credit facilities may not be extended to insolvent companies or companies that do not pass the definition of solvency contemplated in section 4, sub-section (1) (a) of the Companies Act No.71 of 2008. There are two main prohibitions from both the Companies Act and the NCA: The Companies Act of 2008 regulates extension of credit in that it prohibits the extension of credit to an insolvent company, while the NCA regulates individuals in that it prohibits the extension of credit to individuals who are over indebted, under debt review, sequestration and under administration order.

v. National Credit Amendment Act No. 19 of 2014

The National Credit Act No. 34 of 2005 is the most recent comprehensive Act, which repealed all the previous Acts discussed above and was modified by the National Credit Amendment Act No. 19 of 2014, which was assented on 16 May 2014 and came into effect on 19 May 2014. The purpose of the 2014 amendment was to expand certain definitions of the NCA Act No. 34 of 2005 as follows: to allow for the governance structure of the NCR to be altered, to allow the Chief Executive Officer of the NCR to delegate certain functions to other officials of the regulator, to authorise the registration of payment distribution parties, to strengthen measures relating to debt counselling and regulate the conduct of their practices as debt

counsellors, to allow voluntarily cancellation of registration, to empower the Minister of Trade and Industry to issue a notice for the removal of adverse credit bureau information, to allow the automatic removal of adverse credit bureau information, to make provisions for reckless lending to be declared reckless, and to provide for the registration and accreditation of alternative dispute resolution agents.

vi. National Credit Amendment Act No. 7 of 2019

A few years following the adoption of the National Credit Amendment Act No. 19 of 2014, the NCA was again amended by the Credit Amendment Act No. 7 of 2019, which was assented 17 June 2017 and came into effect on 19 August 2019. The National Credit Amendment Act No 7 of 2019 was introduced to improve and augment the National Credit Act No 34 of 2005, with a few new regulations that caused controversy in the financial services industry and particularly for macro lenders as they deemed certain aspects of the amended Bill, counterproductive. Some of the new regulations that resulted in an uproar in the financial sector include new rules on debt intervention measures, reckless lending, and credit life insurance (South Africa. National Credit Amendment Act 7 of 2019).

2.3.3 The introduction of interest rate ceilings

In South Africa, base interest rates are set by the central bank as part of its monetary policy objectives. The benchmark interest rate (the repurchase rate) is the rate that the South African Reserve Bank charges commercial banks when they borrow from the SARB. Commercial banks then add a margin to the repo rate to produce what is known as the prime interest rate. The prime overdraft rate is the minimum interest (benchmark rate) that commercial banks charge their prime customers. Any interest rate above the prime rate is based on the risk grading or customer scoring of each commercial bank. However, the DTI, through the NCA and the powers conferred to it by the NCR, can make or amend laws to regulate fees and interest rates charged by lenders in South Africa. The following table details the maximum interest rates that a formal and registered lender can charge in South Africa.

Table 2.2 Interest rate ceilings

Interest Rate Ceilings		
Credit Type	Maximum Prescribed Interest Rate	Effective Date
Mortgage agreements	RR + 12% per year	7 June 2016
Credit facilities	RR + 14% per year	7 June 2016
Unsecured credit transactions	RR + 21% per year	7 June 2016
Developmental credit Agreements – including: – small business – low-income housing	RR + 27% per year	7 June 2016
Short-term transactions	5% per month on the first loan and 3% per month on subsequent loans within a calendar year	7 June 2016
Other credit agreements	RR + 17% per year	7 June 2016
Incidental credit agreements	2% per month	7 June 2016

Source: Department of Trade and Industry, 2015.

On 6 November 2015, the minister of the DTI published the final regulations on the Review of Limitations on Fees and Interest Rates in line with section 171 (1) of the NCA. The new regulations were to come in force six months from 6 November 2015 and would govern the highest interest rates that a lender can charge as permitted by law. Section 171(1) of the NCA allows the minister to make any regulations expressly authorised or contemplated elsewhere

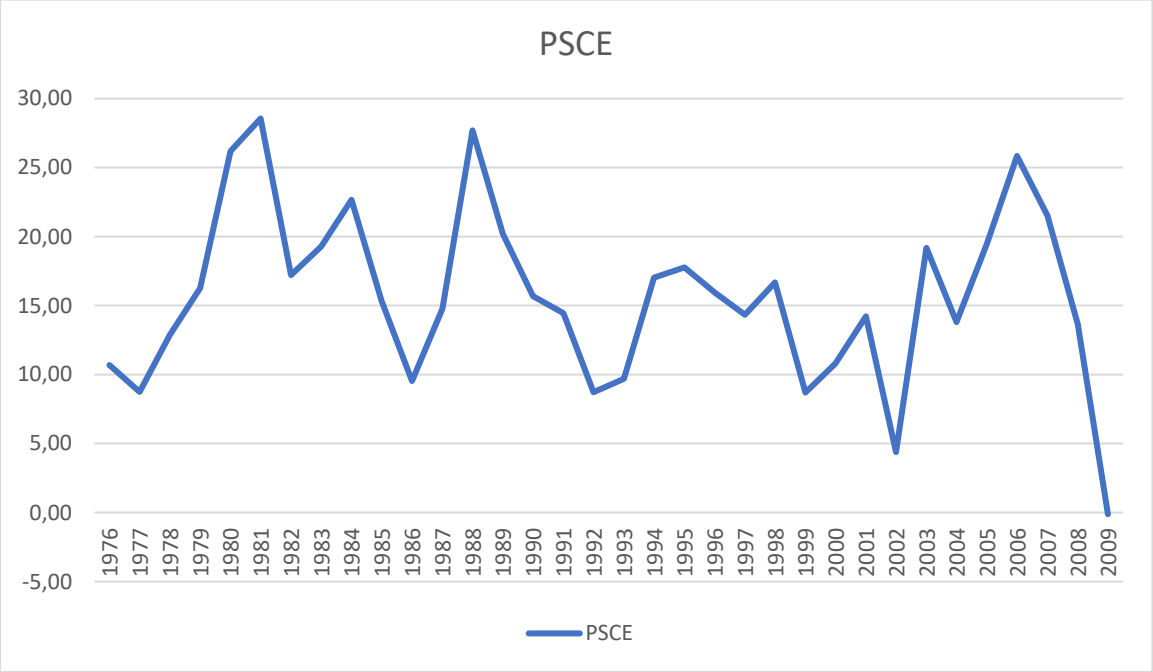
in the National Credit Act and he may, in consensus with the NCR, make or amend regulations for matters relating to the functions of the NCR.

2.4 TRENDS AND DEVELOPMENTS ON PRIVATE SECTOR CREDIT EXTENSION

The following section lays out a view of the trends in private sector credit extension. The researcher analysed a study by Van Der Walt (2019) who examined and discussed the trends from 1976 to 2009 and compares the analysis to statistical data from the South African Reserve Bank (2020).

2.4.1 Trends in private sector credit extension

Figure 2.5 Private sector credit extension from 1976 to 2009



Source: Own compilation based on SARB time series data (in percentages), 2021.

Van Der Walt (2019) holds that the household sector is the principal user of bank credit extended to the private sector; he reports that more than 60% of total credit extended to the private sector by banks is directed towards households. He proceeds to highlight that bank lending to the household sector and firms increased by 17.9% per annum during 1976 and 1996, with a record low of 5.4% in 1977 and a record high of 32% in 1998. However, time series data from the South African Reserve Bank (2020) reveals that aggregate credit

extended to the private sector averaged 12.18% between 1990 and 2018, with a record high of 25.84% in 2006 and a record low of -0.12% in 2009. The analysis of the trends by Van Der Walt differs from the analysis of the researcher due to the data set. Van Der Walt analysed credit extended by banks, while the researcher analysed credit extended to households and firms by all monetary institutions.

There are noticeable downswings and upswings, which are a result of various events that took place in the South African and global economy. South Africa was characterised by economic and political instability during 1976 to 1994, before the apartheid government was overthrown. For instance, the Soweto uprising of 1976 and the State of Emergency of 1986 are some of the events that disrupted economic productivity and led to a deterioration in some economic indicators. In the early 90s, South Africa was suffering from relatively high inflation, which has a negative impact on interest rates and consequently affects credit extension, negatively. Inflation was on average above 10% during the early 90s with a rate below 10% realised between 1995 and 1996. South Africa's inflation rate stabilised under the new governing party that took over in 1994, but deteriorated to an average of 12% in 2002, stabilised again from 2003 to 2006, and deteriorated again from 2007 and 2009, which was during the global financial crisis that saw many economies enter a recession. The impact of high inflation and interest rates can be seen in the decline in credit extension as depicted in figure 2.5.

In addition, research mandated by the NCR (2006) has reported that credit extended to the private sector grew by 67% between 2004 and 2006, and the credit extended to households represented 51% of total credit extended to the private sector, while credit extended to the business sector represented 49% of total credit extended to households and firms. The report argues that the recorded increases in private sector credit extension were due to the then incoming NCA and structural changes that took place in the country during this period (2004 to 2006). The report further identifies falling interest rates as a factor contributing to a substantial rise in credit extended to households and firms. This has ultimately reduced the debt service costs in its entirety and subsequently induced more borrowers to enter the credit market to make use of credit facilities.

The report also identifies the value of fixed property, which is usually used to secure a home loan (mortgage bond) as a balance item sheet. This increases the credit worthiness of a

borrower, which in turn makes it possible for credit providers to increase their appetite for credit extension given that the mortgage bond registered against a financed property gives the seller recourse should a borrower default or fail to meet their contractual obligations. In that case, the lender can sell the property to recover the amount owed to them.

2.4.2 The 2008 financial crisis and private sector credit extension

The SARB (2011) argues that, although the 2008 financial crisis did not directly affect the South African financial system, when the global economy started to deteriorate as exports began to decline, bank lending disappeared. This was due to the pro-cyclical behavior of lenders and the shrinking demand from retail borrowers. As a result, enterprise lending decreased in proportion to household lending due to the economic contraction and subsequently, following the economic meltdown; foreign owned banks contracted their lending activities to maintain short-matched positions while, on the other hand, financing from their head offices dried up and local long-term funding became scarce as a consequent.

The SARB reported that the response of local lenders to the 2008 crisis was less drastic than that of foreign banks, pointing out that evidence suggested the prevalence of a deterioration in lending and a shortening of maturities. The SARB further reports that domestic banks' lending contracted over the crisis period in a sense that credit providers adopted risk aversion and tightened their lending criteria, while the demand from the household sector declined over the period owing to the high levels of indebtedness and the aftermath of high interest rates. The biggest change in bank credit was a rapid decline in the rate of growth in almost all types of loans. This is supported by time series data recorded on the SARB's research and statistics. According to the SARB (2010), global economic activity started recovering due to monetary and fiscal stimulus packages extended by governments world-wide, following the 2008 global economic crisis. The monetary institution reports that in South Africa, credit extension by banks started to pick up as banks' lending criteria showed signs of loosening (SARB, 2010), while the greater rate in impairment of credit advances surged.

2.4.3 Credit ratings and credit extension

The previous section discussed the economic consequences of the 2008 global financial calamity on credit extension and established that South Africa remained resilient against the crisis. The purpose of the following section is to provide a summary of the credit rating

downgrades to non-investment grades between 1993 and 2021 in South Africa, and further analyses how private sector credit extension responded to sovereign credit rating downgrades.

Table 2.3 Sovereign credit ratings history of South Africa from 1993 to 2020

Rating Grade	Name of Credit Rating Agency		
	Standard and Poor Ratings (S & P)	Fitch Ratings	Moody's Investor Services
Non-Investment	3 October 1993	22 September 1994	27 March 2020
Non-Investment	24 November 2017	17 February 1998	20 November 2020
Non-Investment	22 November 2019	28 May 1998	
Non-Investment	30 April 2020	26 July 2019	
Non-Investment		3 April 2020	
Non-Investment		20 November 2020	
Non-Investment		15 December 2021	

Source: Own compilation based on data from Trading Economies, 2021.

The researcher has analysed the South African sovereign credit rating history from 1993 to the end of 2021. This was done to understand the possible impact credit rating that downgrades might have had on credit extension. First and foremost, it is imperative to posit that an institution such as a bank cannot be rated above the sovereign credit rating of its host country (domicile). BASA (2020) also affirms this stance on its review of South Africa's junk status rating by Moody' Investor Services. South Africa subscribed to the Citi Bank's World Government Bond Index (WGBI) in 2012 and started by listing bonds with an estimated market value of $93,82 billion (Reuters, 2020). This index is a platform where countries list their government bonds to attract investors from all corners of the world. Listing bonds at the WGBI is one of the methods of externally raising funds for governments; they do this by issuing bonds that then get listed at this platform for investors to buy. A country whose

government bonds are listed at the WGBI is regarded as credit worthy, as the index only lists bonds of countries with a sovereign credit rating status above non-investment grade.

The impact of a credit rating downgrade – such as junk status (non-investment grade) – on the entire economy is that a country with a non-investment credit rating status gets removed from the Citi Banks's WGBI. Consequently, being removed from the WGBI compels a country to issue bonds to only domestic investors. This may have knock-on effects on borrowing costs, particularly when a country is considered has a junk or non-investment status. The above table summarises and depicts historic periods where South Africa was downgraded to non-investment grades by the three world-wide major credit rating agencies. We compare the periods of the downgrades to junk status with credit extension trends during the same periods. The comparison reveals that private sector credit extension remained stable during the months and years of downgrades to junk status. Time series data from the SARB (2021) reveals that private sector credit extension grew by an annual average of 8,16% in 1993 – down from 9,98% in 1992, while it grew by 8,79% in October 1993 – up from 7,98% in October 1992, and grew by 9,95% in November 1993 – up from 6,98% in November 1992.

In addition, private sector credit extension grew by an annual average of 13,74% in 1994 – up from an average of 8,16% in 1993, while it grew by 15,28% in September 1994 – up from 8,58% in September 1993, and grew by 16,01% in October 1994 – up from 8,79% in October 1993 (SARB, 2021). Furthermore, private sector credit extension grew by an average of 4,87% in 2020 – down from 6,78% in 2019, while it grew by 7,75% in March 2020 – up from 6,04% in March 2019, and grew by 7,11% in April 2020 – down from 7,95% in April 2019, and finally, grew by 6,26% in May 2020 – down from 7,66% in May 2019. It was widely reported that the economy of South Africa was ailing long before the COVID-19 pandemic and credit rating downgrade that ensued in the same year the virus disrupted the global economy; this makes it challenging to attribute the 2020 decline in PSCE to the credit rating downgrade (BASA, 2020).

Moreover, the SARB (2021) revealed that private sector credit extension (PSCE) grew by an annual average of 1% in 2021, while it contracted by -1,49% in March 2021 – down from 7,75% in March 2020, and contracted by -1,65% in April 2021 – down from 7,11% in April 2020 and finally, contracted by -0,31% in May 2021 – down from 6,26% in May 2020. The time series

data from the SARB reflecting contractions in PSCE in 2020 and 2021, does not confirm nor imply that the contractions are a result of credit rating downgrades, as these contractions coincided with the COVID-19 aftermath on overall economic activity across the world. On the one hand, the NCR's 2021 annual report has attributed the decline in credit granted to the COVID-19 impact on overall economic activity because of loss of employment, and loss of income coupled with salary cuts, due to the lockdown restrictions that saw many businesses being classified as non-essential service providers and had to close shop.

On the other hand, Reuters (2020) reported that the exclusion of South Africa's government bonds from WGBI, because of Moody's downgrade to junk status on 27 March 2020, did not have a severe impact as South African local investors cushioned the impact by buying the government bonds delisted from WGBI. This implies that local investors maintained confidence and were still happy to invest in government bonds even on the phase of the credit rating's downgrade by Moody's. The credit rating downgrade was not a shock to South Africa as two of the three main credit agencies had already downgraded the country to junk status between 1993 and 1994, and 2017 and 2019, with Moody's being the only sovereign credit rating agency that maintained South Africa's credit rating at one notch above non-investment grade.

Moody's kept on delaying its announcement following the above downgrades by its counterparts. Its decision to not announce its rating since 2019 was the only reason the country remained in the Citi World WGBI until the agency affirmed South Africa at Ba1 (non-investment grade), on 27 March 2020. The country has remained on junk status (non-investment grade) since 27 March 2020, with Fitch and Standard and Poor affirming Moody's downgrade on 3 April 2020 and 30 April 2020, respectively. The country was last affirmed at BB- (junk status) by Fitch on 15 November 2021. Lastly, the BASA (2020) cautioned that the credit rating downgrade of South Africa will increase the cost of borrowing for both South Africans and government. The association further noted that the country had economic challenges long before the COVID-19 pandemic and the associated lockdown restrictions, which consequently triggered the credit rating downgrade by the only rating agency that kept South Africa at Citi Bank's WGBI.

2.4.4 The trends of private sector credit extension during the COVID-19 global pandemic

The following section outlines details of new consumer credit extended during the COVID-19 period. The purpose of the section is to ascertain whether COVID-19 had an impact on PSCE or not. The section starts with a summary of credit extended and proceeds to discuss the trends that took place because of the COVID-19 disruption on overall economic activity.

Table 2.4 New consumer credit extended before and during the COVID-19 global pandemic

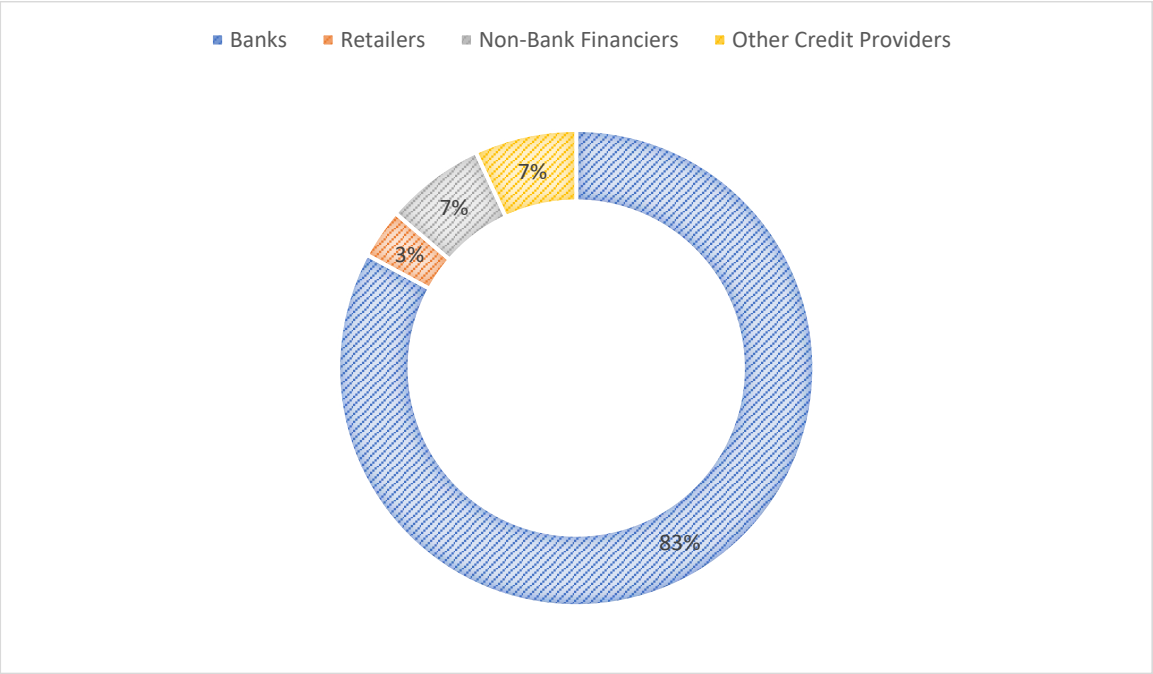
Type of Lenders	New Consumer Credit Extended Per Year (in ZAR billions)			
	2018	2019	2020	2021
Banks	R410.8	R438.99	R378.31	R508.46
Retailers	R23.26	R23.61	R14.33	R20.72
Non-bank fanciers	R43.61	R43.86	R40.38	R41.66
Other credit providers	R53.88	R44.50	R27.69	R42.47
Total	R531.55	R550.96	R460.71	R613.31

Source: National Credit Regulator Consumer Credit Market Report, 2021 Q4.

Other credit providers consist of pension backed lenders, developmental lenders, micro finance lenders, agricultural lenders, insurers, non-bank mortgage lenders, and securitised debt (NCR Consumer Credit Market Report, 2021, Q4). As seen in table 2.3, new consumer credit granted was on an upward trend before the COVID-19 pandemic hit South Africa in 2020, from R531,55 billion in 2018 to R550,96 billion in 2019. New credit declined to R460,71 billion in 2020 Q4 and the NCR (2021) ascribed this decrease to the disruptions brought by the corona virus of 2019. One of the features of the COVID-19 pandemic was lockdown restrictions, which saw businesses losing income and employees losing jobs. This lasted for the 2020 calendar year through to 2021. However, things started to normalise, and economic activity started to stabilise, which led to new consumer credit extended – improving and surpassing pre-COVID-19 levels to R613,31 billion by the end of 2021 Q4 (NCR, 2021).

The following figure is a continuation of table 2.3. Its purpose is to provide a breakdown of new credit extended by type of lenders as at 31 December 2021, as a percentage of total credit extended in a year.

Figure 2.6 New credit granted by type of lenders in 2021

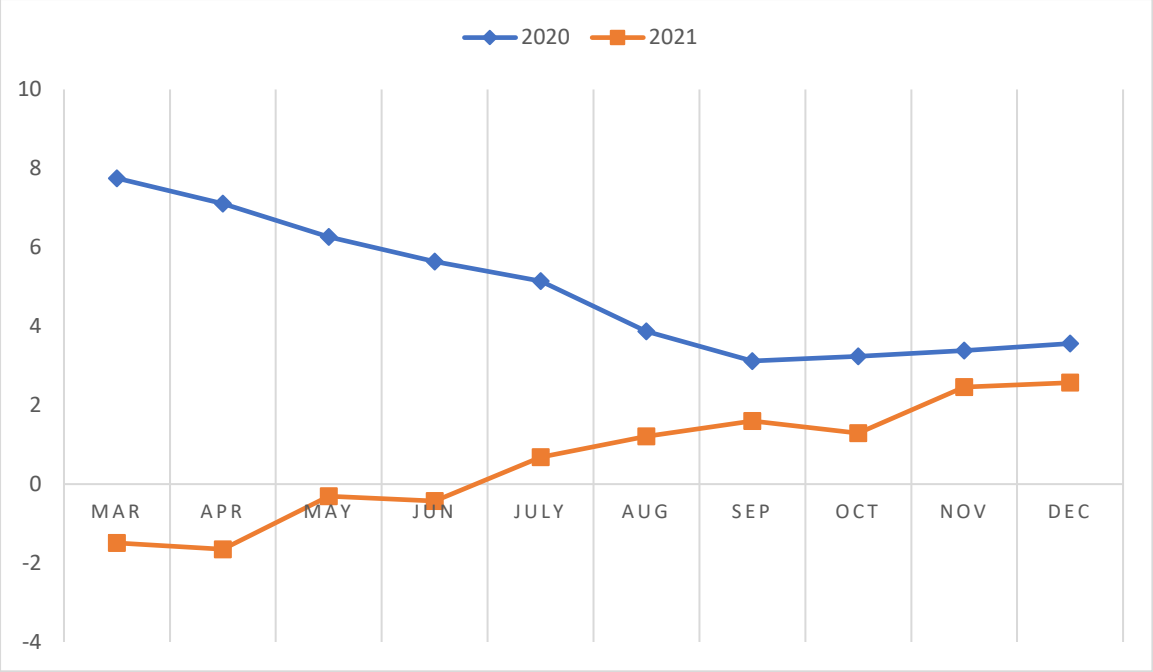


Source: Own compilation based on data from the National Credit Regulator, 2021.

Total new credit extended in 2021 was reported at R613,31 billion. As seen in the above diagram, in 2021, banks extended new credit of R508,46 billion (83%), retailers extended new credit of R20,73 (3%), non-bank financiers extended new credit of R41,66 billion (7%), and other credit providers extended new credit of R42,46 (7%) against total new credit of R613,31 billion (NCR, 2021). This diagram confirms that banks are the largest contributor to new credit extended (NCR 2021).

The following figure provides a graphical representation of PSCE from March 2020 to December 2021. This graph represents month on month percentage change in PSCE between the third month of 2020 to the last month of 2020, and the third month of 2021 and the last month of 2021.

Figure 2.7 Private sector credit extension in percentage change from 2020 to 2021



Source: Own compilation based on data from the National Credit Regulator 2021.

In its 2021 annual report, the NCR reported a sharp decline in new credit extended to households in quarter 2 of 2020. The regulator reported that new credit decreased from R126 billion to R54 billion in quarter 2 of 2020 and picked up to R129 billion in quarter 3 of 2020 and subsequently surged to R154 billion in quarter 4 of 2020. The regulator attributed the decline in new credit extended, to the COVID-19 pandemic, which hit South Africa early in 2020, with the first case reported on 5 March 2020. The country was placed on national lockdown on 26 March 2020. This lockdown resulted in many businesses suffering, many people losing their jobs, and some had their salaries reduced given that most businesses saw a decline in business activity during lockdown and subsequently, saw a reduction in income.

The NCR (2021) further pointed out that the country had one of its highest rejection rates on consumer credit requests as many borrowers could not meet the requirements for either new or increases in existing credit facilities. The lockdown restrictions that started in March 2020 were categorised into five alert levels and were eased in subsequent stages as reported cases became less. Credit providers noticed the impact of the pandemic and assisted customers with moratoriums – a common debt intervention method where borrowers are given payment holidays. A payment holiday allowed a customer to skip payments for a certain period, due to deterioration in financial circumstances because of the pandemic. The

payment holidays ranged from three to six months and were applicable to both borrowing households and firms.

Banks were not the only role players to provide relief to borrowers. As part of the NRC's remedial measures against the COVID-19 pandemic and to reduce the impact on borrowers, the credit watchdog recommended that distressed borrowers consider credit life insurance, debt counselling or review, or the surrendering of financed goods such as vehicles or houses. All these debt intervention methods were always made available by the regulator, and credit providers are also privy to these relief measures.

The following section outlines various relief packages that were introduced by various organs of the state, as part of the measures taken against the corona virus of 2019. The relief measures were aimed at assisting both businesses and employees to cope during COVID-19 disruptions.

i. South African Future Trust (SAFT)

At the onset of the 2020 national lockdown, which commenced 26 March 2020, various stimulus packages followed as part of the country's responses aimed at curbing the economic impact of the global pandemic, on both businesses and households. One of the main relief measures was the South Africa Future Trust established by one of South Africa's richest men, Nick Oppenheimer. The package was established with a total of R1 billion to be distributed as interest free loans to businesses, for a period of five years. The relief package was administered by commercial banks and was meant for businesses categorised as SMMEs with a turnover of less than R25 million per annum, in good standing as at 29 February 2020. They should also have traded for a minimum of two years and should have been impacted by the 2019 corona virus disease. The South African Future Trust package disbursed R1.04 billion in loans and assisted 9 656 qualifying businesses.

ii. Government R500 billion stimulus package

On 21 April 2020, the head of state (President Cyril Ramaphosa) announced a relief measure by the government of South Africa, as part of its responses aimed at helping businesses and households weather the storm brought about by the COVID-19 pandemic. This relief measure was by way of a R500 billion economic stimulus package, where R200 billion was allocated to

a guaranteed scheme where government guarantees bank issued loans to enterprises with an annual turnover of not more than R300 million.

The R500 billion was allocated to various sectors of priority such as boosting the health care system with a R20 billion allocation, intended at ensuring that the health care system did not collapse on the rise of COVID-19 cases and hospitalisation. R200 billion was allocated to a loan guarantee scheme where commercial banks collaborated with the National Treasury and the South African Reserve Bank to facilitate the extension of loans to qualifying businesses. The R200 billion was structured in a sense that the National Treasury initially allocated R100 billion, with an undertaking to allocate the remaining R100 billion as loan take up increases for COVID-19 relief. These loans were intended to help businesses to pay salaries and suppliers as most businesses classified as non-essential service/goods providers remained closed during the first few months of the hard lockdown. As a result, they could not earn income to keep paying salaries, rent and suppliers as some of these expenses are commonly fixed.

South African households are characterised by high debt to disposable income ratio at 67% as at December 2021 (SARB, 2021). This implies that most household income is channeled towards servicing debt. The unfortunate reality of the COVID-19 pandemic impact on households is that most lost their incomes, while some had their incomes reduced, but some expenses remained fixed and payable. Employees who suffered these consequences were assisted though a portion of the R200 billion loan guarantee scheme, which ensured that those whose employers were impacted continued to receive their monthly salaries to maintain their living expenses and service their existing debts.

The R200 billion loan guarantee scheme had a directive from the National Treasury and the South African Reserve Bank stipulating that commercial banks should charge a preferential rate (prime) and allow businesses the option to defer repayment by 6 to 12 months from the date the loan was availed, and only start repaying on the 7th or 13th month respectively thereafter. The R200 billion loan guarantee scheme was intended to help struggling businesses and employees – it was a huge sell when announced by the head of state and was welcomed by most South Africans. The consequence of this initiative was that the relief did not realise its intended purpose and success rate, as only R18,39 billion was approved and

taken up by 19 June 2021 (BASA, 2021); the scheme had an expiry date of 28 June 2021, but remained open until 11 July 2021 to allow loans in the process of being assessed by banks, to be finalised.

BASA (2021) attributed various factors to the failure rate of the scheme such as business owners' reluctance to take on debt during tough economic times, businesses not being in good financial standing as at 31 December 2019 or 29 February 2020, and some businesses rejecting the scheme citing that they had made alternative relief arrangements directly with their banks. Subsequently, government removed the R300 million turnover as a requirement for businesses to qualify and allowed a qualifying business to borrow a maximum amount of R100 million. This was done to boost and encourage loan take up by businesses. In addition, the South African Reserve Bank also came to the rescue and provided relief by way of decreasing the repurchase rate, which ultimately reduces the prime lending rate. When announcing the interest rate cuts as part of its relief measures, SARB (2021) cited an increased credit tightening by banks due to their decreased credit appetite during economic downswings. This could partly be attributed to the low approval rate of the R200 billion loan guarantee scheme facilitated by commercial banks.

Credit providers along with many businesses – such as retailers (food supermarkets, fuel filling stations etc.) classified as essential service providers – incurred huge costs as part of the responses necessary to ensure that they enabled their employees to work remotely by buying laptops and data sim cards, or by buying personal protective equipment such as masks and sanitizers for employees who could not work from home as they were required to work in the office as per normal (an example is bank tellers and cashiers at food outlets such as Pick n Pay). The major downside of this was that revenue for institutions such as banks, insurance companies and fuel filling stations were impacted as non-essential businesses closed, which led to their employees staying at home. This in turn reduced the need for spending on fuel to drive to and from work, while operating expenses increased due to personal protective equipment, sanitizers and other related costs that had to be incurred to keep the essential service providers trading during hard lockdown.

On the one hand, the International Finance Corporation (2021) reported that a huge number of SMMEs were credit constrained due to the lack of proper and reliable credit history, which

consequently prevents credit providers from conducting a full credit assessment when requested by the borrowers. On the other hand, the NCR (2021) reported that the prevalence of COVID-19 and its associated lockdown restrictions adversely affected South African households in that it pushed many individuals to demand more unsecured credit than they would normally obtain in the formal credit market. This was because most of them lost jobs and had reduced incomes and as such, resorted to borrowing from retailers (store cards) so that they could maintain their monthly living expenses during hard lockdown.

Meanwhile, the SARB (2021) also noted that the impact of the 2019 corona virus disease on banks included reduced income and profitability because of reduced NIR, low interest income due to repo rate cuts, and impairments on non-performing loans. Furthermore, BASA (2021) reported that banks provided relief to both corporates and households to the tune of R293 billion, made up of R165 billion to corporates and R128 billion to households. BASA further highlighted that the relief package provided by commercial banks was estimated to represent 5,8% of the total credit exposure that banks have with both corporate and household borrowers.

Lastly, as part of its broad measures against the economic turmoil brought about by the 2019 corona virus disease, the South African Reserve Bank provided unprecedented relief by way of rate cuts of up to 275 basis points between March and June 2020. The SARB usually announces rate changes during its monetary policy meetings, which take place only five times a year between March and November; however, the 275 basis points reductions were announced outside its normal scheduled announcements. There is margin of 3,5% between the repo rate and the prime lending rate. The rate reductions led to banks adjusting their prime lending rate, which serves as a base lending rate for commercial banks. The SARB (2021) reported that the rate reductions benefited households more than corporates. The lender of last resort further noted that the interest rate offered by deposit-taking institutions to households was reduced to less than the deposit rate offered to corporates. This implies that while household borrowers enjoyed the 275 basis points reductions, household savers maintained better interest income as their deposit rates were not reduced drastically (SARB, 2021).

The previous section discussed some common relief packages that were introduced as part of the responses aimed at assisting businesses and individuals manage the financial impact of COVID-19. The following section provides various other relief measures that were introduced and made available to both businesses and individuals in addition to those that were publicly announced when hard lockdown restrictions commenced in South Africa.

Table 2.5 Other relief funds established because of the COVID-19 pandemic

Name of scheme	Maximum amount to apply for	Relief type covered by the scheme	Qualifying criteria
National Treasury – R200 billion loan guarantee scheme	R200 billion	Government backed guarantee scheme.	A business must be registered in line with South African laws, be affected adversely by COVID-19 tax compliance, and must have an annual turnover of less than R300m.
South African Future Trust (SAFT)	R1 billion	A non-interest-bearing loan to be extended for a maximum period of 5 years. The purpose of this loan is to assist businesses to pay salaries to permanent employees. The relevant financial institution will transfer funds directly to the employees with a maximum of R750 weekly for each employee. The salaries are to be paid for a maximum of a 15-week period and the business remains the principal debtor of this relief package.	SMMEs with an annual revenue not exceeding R25m per annum. The business should have been in existence for a minimum of 2 years, must be negatively impacted by COVID-19, and must be compliant with relevant South African regulations and requirements such as tax compliance.

Department of Small Business - Debt Relief Finance Scheme	R200 million	This loan is to be extended to registered businesses at a rate of 5% below the prime lending rate. The loan is designed to assist businesses with working capital needs and other capital outlay requirements.	A business must be registered, have an existing trading history, and be affected negatively by the corona virus of 2019. The shareholders of the business must be South Africans with a minimum of 70% of employees being South Africans. The business must be in good standing with the South African Revenue Service and the Unemployment Insurance Fund.
Department of Tourism – COVID-19 Relief Funding	R200 million	The fund is designed for SMEs trading in the tourism and hospitality industry, which have been impacted adversely by the corona virus of 2019.	The business must be registered, operate in the relevant industry, and having been trading for over 12 months with an annual revenue not exceeding R2.5m. The business must be in good standing with the South African Revenue Service and the Department of Labour's Unemployment Insurance Fund.
Industrial Development Corporation – MCEP COVID-19 Programme	R300 million	The funding is restricted to R30m for each borrower, with an interest of 2,5% yearly and it is for a maximum duration of 4 years.	The businesses must be regarded as essential service providers trading in the manufacturing industry and must have traded for over 12 months. The business must provide a valid off-taker agreement between them and their

			customers and must be compliant with BEE.
Department of Sports, Arts and Culture	R150 million	Funding intended for businesses and individuals that generate revenue through art, events, and events management.	Businesses and artists must prove that they generate income through events, art or events management.
Industrial Development Corporation – IDC COVID-19 Essential Supplies Intervention	R500 million	The loan is revolving, restricted to a maximum of 12 months, and priced at prime overdraft rate plus 1% annually. The IDC backs banks that extend credit to businesses and guarantees these loans as collateral.	Businesses that trade in the manufacturing space and have experience of importing on a larger scale. The business must have the relevant accreditation and must have valid and secured off takers for the goods in question.
Department of Small Business Development	Funding amount not confirmed	The funding is intended for business overheads and to acquire assets that generate revenue. The funding attracts an interest rate of prime less 5%.	Businesses must be owned by females who are classified as youth in the definition of youth in South Africa.
Department of Agriculture, Forestry and Fisheries	R1.5 billion	The funding is intended for businesses and individuals who generate income from agricultural activities.	Qualifying applicants are businesses and individuals trading in agricultural activities.

Source: South African Venture Capital and Private Equity Association (SVCA), 2021.

2.5 CHALLENGES FACED BY LENDERS AND BORROWERS IN SOUTH AFRICA

According to the South African National Treasury (2011), the financial service sector plays an important role in the lives of all individuals in South Africa, through its ability to enable economic growth, creating employment, funding the construction of infrastructure and overall contribution towards sustainable development of the South African economy. The

department has pointed out that there is lack of financial inclusion in South Africa and that this is evidenced by the number of individuals operating outside the formal financial sector. Studies such as those by Mutezo (2013) and Fatoki and Odeyemi (2010) have analysed credit rationing and access to finance by SMMEs in South Africa, respectively, and argued that the age of a business and collateral play a pivotal role in obtaining credit from the formal credit market. Mutezo (2013) pointed out that small enterprises struggle with accessing credit from financial institutions due to the owner's lack of financial knowledge, lack of fixed assets to provide to the lenders as collateral, and poor credit history. The following section describes the challenges from a lenders and borrower's perspective.

2.5.1 Challenges faced by lenders

i. Information asymmetries

Fatoki and Smit (2012) hold that financial institutions require collateral to compensate for the lack of normal information required from borrowers when assessing a credit application. They further report that one of the challenges that contributes to a bank's unwillingness to freely extend credit to new SMEs, is incomplete information, which gives rise to adverse selection. Similarly, Mutezo (2013) argues that information asymmetry is another factor leading to financial institutions rationing credit to businesses. The researcher holds that financial institutions use imperfect information to categorise credit risk and subsequently, charge high interest rates, which discourages small business enterprises from external financing. The previous assertion is supported by National Treasury (2001), which argued that infant businesses and newly established enterprises have limited access to credit due to poor credit history; banks require a good credit history to fully assess credit applications. Yoshino and Taghizadeh-Hesary (2017) also support this view; they argued that most SMEs struggle with obtaining affordable finance due to the problems of information asymmetries.

In support of the above view, National Treasury (2001) posits that external factors such as regulatory requirements result in a bias on the allocation of credit. The finance department argues that regulatory requirements of the Usury Act, the Credit Agreement Act, and the Usury Exemption Notice create a bias on how credit is allocated and subsequently extended to SMEs. On the other hand, Okurut (2005) holds that information asymmetries raises the probability of a borrower defaulting, which makes lenders cautious of who they consider extending credit to. Okurut believes that lenders tend to ration credit to the poor due to the

high costs that they incur when obtaining information about the credit history of a potential borrower. The researcher argues that this leads to lenders requiring collateral to compensate for the anticipated default risks. In addition, Turner, Varghese and Walker (2008) hold that in a country defined by a highly sophisticated financial services sector, credit providers are moving towards an information-based assessment of credit applications. As a result, many SMEs struggle to obtain credit due to the lack of information required to enable credit providers to assess and make sound lending decisions. The above-mentioned researchers further argue that credit providers struggle to verify details of collateral offered to them by borrowers and this leads to credit rationing due to the inability of the credit providers to verify that the collateral being offered is not pledged to other lenders.

ii. Risk aversion

KPMG (2013) contends that borrowers tend to be credit constrained due to credit risk policies and structures of the financial system. The auditing giant further posits that credit rationing also stems from risk aversion measures by lenders (banks in particular). The accounting institution also attributes these measures to the view that financial institutions have towards development projects, which are argued to be part of the factors leading to high failure rates of businesses. Kauffman (2005) contends that SMEs in Africa are credit constrained due to high default risk and inadequate financial facilities. Kauffman further argued that most businesses are seen as high risk due to lack of collateral and opaque information on credit repayment history. The NCR (2021) also believes that the credit risk policies and appetite of established credit institutions inhibit borrowers from accessing credit at the required level.

iii. Regulatory requirements

BASA (2018) holds that regulatory requirements such as the NCA's regulation of reckless lending and the lack of proper risk mitigation measures such as government loan guarantee schemes, leads to lenders constraining credit at the desired level. This view is supported by Sophocleous (2018) who highlighted that although internal factors can be addressed and managed by business borrowers, external factors such as regulatory requirements inhibit businesses from obtaining credit. The researcher argues the adoption of the National Credit Act led to most businesses accessing less credit compared to the pre-NCA era. Smit (2019) echoes the views of his counterparts (BASA, 2018 and Sophocleous, 2018) and stresses that external factors such as regulatory requirements are factors contributing to credit rationing.

2.5.2 Challenges faced by borrowers

i. Lack of financial knowledge

Chitimira and Ncube (2020) hold that poor and low-income earners of South Africa tend to voluntarily exclude themselves from formal financial sector services due to their mistrust of the banking sector and cultural beliefs. Hilton and Naidoo (2006) analysed obstacles to finance for women in South Africa in their study, which focused on access to finance for women entrepreneurs in South Africa. They reported that poor understanding of terminology used in finance and the lack of knowledge of bank and micro lenders services are deterrents to accessing finance. This is coupled with lack of understanding of credit processes and how credit bureaus work. The attitudes of banks were also identified as an obstacle.

ii. Lack of owners' contribution and collateral

Fatoki and Smit (2012) contend that the lack of an owner's contribution, often referred to as owner's capital injection, backed by strong collateral, are some of the major factors leading to lenders constraining credit to newly established businesses and SMEs. This view is supported by September (2021) who argues that one of the obstacles faced by borrowers in South Africa is the lack of owner's contribution. In addition, Fatoki and Smit (2012) hold that commercial banks usually require collateral as security for credit requested by new SMEs. Hilton and Naidoo (2006) hold a similar view and argue that the emphasis of collateralised and asset-based lending diminishes the capability of women's access to finance. Similarly, National Treasury (2001) holds that, while SMEs have sufficient collateral required to obtain credit, most start-ups and micro enterprises from previously disadvantaged groups are credit constrained due to the lack of collateral.

iii. Lack of business plans and financial records

In a perfect world, the establishment of every business comes with a business plan and financial projections, coupled with personal balance sheets and valuations reports of fixed properties or assets aimed at motivating for credit facilities. Fatoki (2014) holds a similar view and argues that the maintenance of proper business plans, the maintenance of a good relationship with lending institutions and credit rating reports are major factors that lenders consider when assessing a request to finance or fund a business enterprise. The BASA (2018) conducted a study on hurdles faced by financial institutions in SMME financing and

established that financial institutions find it difficult to fund SMMEs due to unavailable business plans and lack of financial knowledge.

iv. Loan pricing and other borrowing costs

Karley (2003) argues that from the demand side of credit, South Africans are not able to obtain credit due to affordability issues. Obtaining credit comes at a cost that many start up or small enterprises cannot afford – costs such as interest rates, initiation fees, monthly service fees, early settlement penalty fees and credit life. On the other hand, Hilton and Naidoo (2006) believe that lenders are not creating suitable and fit for purpose financial products and most of these products are unaffordable. The authors argue that women do not have the financial strength that men have, and this affects their confidence and ultimately discourages them from seeking external finance for their businesses. The authors further argue that pricing is another challenge facing both borrowers and lenders; this can also be seen in the interest charged for both prime and sub-prime borrowers. In addition to pricing, Basel III is calling for reductions of margins where credit providers are required to hold higher capital requirements, and lastly, the deposit required by credit providers when a borrower is required to put down for an application of finance to be finalised.

This is like administration costs charged by dealerships for originating a vehicle and asset financing on behalf of a borrower and a lender. There are also other costs such as legal fees, which a credit provider incurs to get an eviction order, and to evict a defaulting homeowner to sell the property and recoup the amounts extended to the homeowner when the loan was initiated. In addition, there are debt review costs. Sophocleous (2018) also holds a similar view and argues that one of the factors that leads to banks rationing credit to certain borrowers, is the cost involved in granting credit, which is often not justified by the return from extending credit to those customers.

v. Age and size of a business

Finmark Trust (2015) reported that the size of a business has a proportional impact on credit extension. The organisation highlighted that bigger firms have a greater chance of obtaining credit as opposed to their small, medium, and micro counterparts. The NCR (2021) holds that small and new businesses tend to avoid requesting credit from the formal credit sector due to physical or tangible collateral being required by formal credit institutions and choose to rather borrow from the informal credit markets, which usually require social collateral for

extending credit. The regulator argues that this social collateral is based on reputation, trust, and social compact, which provides comfort to a lender that the borrower will repay the debt.

vi. Management quality

Fatoki and Smit (2012) also believe that lenders are concerned by the expertise and management quality of SMEs' management and the anticipated failure to perform, which may give rise to moral hazards. This view is supported by the NCR (2021), which argues that most informal businesses are managed and owned by individuals who lack the necessary education; this often speaks of the expertise and skills that management is required to have from a lender's perspective.

2.6 CONCLUSION

This chapter focused on factors that affects PSCE and the first factor discussed was regulatory developments. It was established through literature that the enactment of the National Credit Act No. 34 of 2005 has resulted in less credit being extended by lenders as it introduced new rules and criteria that lenders needed to follow when assessing credit applications. The chapter also discussed the impact of the 2008 financial crisis, credit ratings and the COVID-19 impact on PSCE. It established that there is no evidence or literature that suggest that credit ratings have an impact on PSCE. The analysis also established that the COVID-19 pandemic affected PSCE between March 2020 and December 2021. Lastly, the chapter discussed interest rate ceilings and how they affect credit extension and concluded the chapter by discussing the challenges faced by lenders and borrowers.

CHAPTER 3: LITERATURE REVIEW

3.1 INTRODUCTION

The previous chapter unpacked the South African PSCE landscape. This included discussing South Africa's financial sector, role players in credit extension, regulatory bodies, trends, and developments, as well as the impact of credit ratings, the 2008 economic crisis and COVID-19 on PSCE.

This chapter builds on the previous chapter by describing the theoretical framework on credit, theoretical determinants, and empirical literature on PSCE. The chapter kicks off by discussing the theoretical framework of credit and proceeds to describe the theoretical determinants of private sector credit from a demand and supply side perspective. The chapter concludes by analysing some empirical literature from international economies, sub-Saharan Africa, and South Africa.

3.2 THEORETICAL FRAMEWORK

There are predominantly three theories of credit, with various proponents holding different views dating back to the classical era of economics. The three theories are the financial intermediation theory, the fractional reserve theory, and the credit creation theory. Each theory will be discussed separately below.

3.2.1 The financial intermediation theory

According to this theory, lending institutions utilise deposits collected from their customers and lend these funds out to their borrowers. This theory is supported by various economists, including Von Mises (1912), who argued that credit is created through financial intermediation where banks utilise the funds received from the surplus units and extend these funds to the deficit units of the economy. Von Mises simply argues that lenders collect deposits with short-term maturities and lend them out as long-term loans. In support of this theory, Keynes (1936) argued that investment can only take place when there are savings in the financial system. His argument implies that credit can only be created from deposits collected from the public. Bernanke (1993) holds a similar view and argues that the credit creation theory of banking is a process in which the savings of the individuals and firms are made available for use by other individuals and firms. He argues that a firm's willingness to

invest and borrow is determined by the physical production of capital and interest rate and ultimately, this depends on a household's desire to save and wealth holders' liquidity preference. He posits that the essence of the credit creation process is the gathering and transformation of information by lenders and borrowers alike.

3.2.2 The fractional reserve theory

The fractional reserve theory disagrees with the financial intermediation theory and argues that banks apply the money multiplier to create credit by using multiple deposits from their customers. This theory also has its proponents; one of them is Crick (1927), who argues that lenders collectively create credit by individually collecting deposits from their customers and make use of the money multiplier to create credit to be extended to their borrowing customers. In support of Crick's views, Hayek (1929) contends that banks employ the concept of money multiplier by holding the reserve required by their central banks and lending out the rest of the customers' deposits held in their books. Hayek further highlighted that the difference between the reserve held with central banks and the remaining deposit held by commercial banks, leads to multiple creations of credit deposits within the banking system and this is ultimately converted into credit.

3.2.3 The credit creation theory

The credit creation theory is in contrast to both previously discussed theories and holds that individual lenders create credit whenever a new loan is extended. The argument here is that credit is only created when entries are recorded in the books of a bank and the borrowing customer during loan origination. This theory is supported by economists such as Macleod (1906), who argues that, while banks collect deposits from their customers, credit is only created when a loan is granted to a borrower and the funds transferred from the books of the bank to the loan account of the borrower within the same institution. In support of Macleod's argument, Davenport (1913) contends that although banks collect deposits from the surplus units, real credit is only created when a loan is granted to a borrower. Davenport (1913) holds that a loan needs to be generated and must be in place for credit to exist.

The above section discussed how credit is created. We now look at what factors credit providers and borrowers consider when extending and requesting credit, respectively. The purpose of this study is to examine what determines credit from a demand and supply

perspective. Various theories are documented on what determines credit and various authors have similar and differing views. For instance, Jen (1963) posits that the decision of a lender to extend credit to a firm is based on the profitability of the firm compared to the rate of return on assets of that firm. The author further highlighted that lenders also consider solvency when assessing the credit risk of a firm. Lastly, Jen argues that lenders also consider their own asset base when deciding on the amount of credit to avail to borrowers.

In addition, Stiglitz and Weiss (1981) hold that the demand for loans and the supply for funds are functions of the interest rate. The authors highlighted that firms and individuals consider the interest rate to be charged when deciding to borrow; the same applies to lenders because the reward of extending loans is interest income. Alternatively, Okurut (2000) argues that the demand for credit is influenced by institutional factors such as location of a financial institution, product features such as interest rates, and household socio-economic characteristics such as the wealth status of a borrower. Lastly, Kalluci and Shijaku (2013) contend that credit is determined by both the demand and supply side indicators. The following section comprehensively discussed the determinates of credit extension from a demand and supply side perspective.

3.3 DETERMINANTS OF PRIVATE SECTOR CREDIT

This section reviews the theoretical linkage between each determinant and PSCE from a demand and supply perspective. First, we define the term, private sector credit. According to Bernanke (1993), credit extension is the process of channeling savings or surplus funds for use by the deficit units or borrowers. He argues that this process is well facilitated by banks in their special nature of being able to extend credit to borrowers who would find it difficult to borrow from other sources due to imperfect information.

3.3.1 Demand side determinants

This sub-section discussed the theoretical determinants of credit extended to the private sector from the demand side. The purpose of the section is to describe how each demand side determinant affects private sector credit.

i. Gross domestic product

Hofmann (2004) established that economic activity measured by GDP positively affects consumption by households and investment demand by firms. Households are willing to borrow now and spend the future unearned incomes because they are confident the economy will grow to a point that will enable them to repay the loans in the foreseeable future. Firms are also willing to invest in new projects because, as the economy grows, the prospects of increasing return on investments also grows. Imran and Nishat (2013) contend that a positive change in economic activity leads to an expansion in the income of the firms that operate in the manufacturing sector, as well as the earnings of the public. This subsequently leads to an increased demand for credit.

Afolabi et al. (2012) hold that, from a demand perspective, an improvement in total national output leads to a surge in credit demand as firms see an opportunity to enhance productivity. This requires an increase in working capital due to the anticipated corresponding rise in demand for their goods and services. On the other hand, the author posits that, during economic downturns, the demand for goods and services falls as firms also reduce their demand for credit in line with reduced demand for their goods and services. According to Muriu (2016), an improvement in GDP has the potential of attracting investors due to anticipated profitable projects.

ii. Real wage rate

Literature shows that real wage rate is positively related to private credit extension (Kalluci & Shijaku, 2013). On the demand side, wages are another measure of wealth as those with higher wage rates tend to qualify for credit facilities with ease due to evident repayment abilities of potential credit facilities. In addition, the private sector conservatively manages costs during an economic downturn, and this enables private individual borrowers to obtain more credit when the economy stabilises (Kalluci & Shijaku, 2013).

iii. Property prices

Like the impact of real wage rate, property prices are seen as the positive determinants of credit extension. The prices of fixed property can affect credit demand indirectly through wealth effects; this is based on the premise of the life cycle model of household consumption.

The hypothesis holds that the owners of fixed immovable property often respond to an increase in house prices by expanding their expenditure needs and borrowing to smooth out consumption over the life cycle. Consequently, a surge in property prices tends to result in rental increment, which may lead to renters lowering consumption and borrowing (Hoffman, 2004).

iv. Interest rate

Studies show that interest can have a negative or positive impact on credit demand. According to Hoffman (2004), high interest rates make borrowing expensive and consequently lead to a decline in credit demand. Similarly, Muriu (2016) posits that high interest rates discourage borrowers from demanding credit as the face value of long-term loans is vulnerable to inflation, compared to short-term loans. On the other hand, Khangalah (2013) argues that credit extension tends to increase when interest rates decrease. The author argues that one of the consequences of this is currency devaluation. In addition, the author posits that when interest rates are low, borrowers demand more credit as they see more investment opportunities and a need to purchase more durable goods.

v. Inflation

Becke et al. (2006) hold that high inflation results in a decline in the demand for credit. This is due to the erosion in purchasing power resulting from high inflation and because high inflation usually prompts monetary authorities to increase interest rates to discourage spending and stimulate the economy. Consequently, a rise in interest rates is expected to result in a drop in credit demand. Similarly, Adeleke and Awodumi (2018) posit that an upward trend in the general price level signals a rise in input costs, which tends to affect the growth of businesses and consequently leads to banks reducing credit extension to their business customers during high inflationary periods. The authors argue that the same applies from a demand perspective, where increasing cost of production forces firms to decrease their demand for credit.

In addition, Dlamini et al. (2017) hold that a consistent rise in inflation leads to an increase in the expenses associated with investing and household consumption. The authors argue that an increase in the cost of investing and consuming implies that inflation is high, and therefore

reduces the amount of funds required by both household and firms as they find it expensive to engage in both investing and consumption activities.

vi. Debt service ratio

Garcia-Luna, Mohanty and Schnabel (2000) argue that a reduction in the interest charged to households, coupled with a decrease or stability in inflation rate, results in a decrease in both nominal and real interest rates. This reduces initial debt servicing costs relative to income, which then results in an increase in the demand for credit. Similarly, most unsecured credit facilities extended to the household sector come with insurance and service fees, which implies that a decrease in these associated costs will reduce the cost of servicing debt and would encourage borrowing as opposed to the reverse.

vii. Real effective exchange rate

Exchange rate movements affect private sector credit in two ways from the demand side. Firstly, exporting firms usually thrive when the domestic currency depreciates against foreign currency because they get more value from their exported goods. Secondly, importing firms would take advantage of domestic currency appreciation in return for foreign exchange gains when they resell the imported goods. Exporting and importing firms usually depend on trade finance for working capital and any movement in exchange rate will affect their demand for credit (Imran & Nishat, 2013, Kalluci & Shijaku, 2013 & Temesgen, 2016).

Muriu (2016) holds that the deterioration of a country's exchange rate reduces the return on investment for importers and local producers who source their inputs from the international market. This deterioration tends to cost them more to import goods and subsequently results in a decrease in the credit demand. On the other hand, the author contends that exchange rate appreciation has the opposite effect on exporters, as it increases the return on their investment where they get more of the local currency in exchange, which subsequently leads to more credit being demanded.

viii. Public sector credit

Bonga-Bonga and Mabejane (2009) hold that when faced with a fiscal deficit, government tends to borrow from the capital market, which in turn raises the request for funds by the

public sector. This rise in demand leads to a surge in borrowing costs (interest rates). As defended by theory, a rise in borrowing costs leads to a decline in credit demanded by the private sector. Sacerdoti (2005) argues that a key determinant of private sector credit is government deficit and the size of credit the government requires from the banking sector. The author highlights that government deficit tends to be financed domestically, which provides the banking system with an opportunity for a relative safe investment of their deposit base. He further noted that this raises interest expenses and decreases the number of financial resources channeled to the private sector.

Furthermore, Kamaly and Shetta (2014) posit that there is a crowding out effect between government credit and private investment. The authors argue that when government issues debt instruments to finance the deficit, it entices banks to move away from risky private sector borrowers and towards investing in government debt instruments because private sector borrowers are seen as riskier compared to the public sector. Anyanwu et al. (2017) posit that government deficit financing has different ways of affecting credit extension and highlighted that one of the ways is through an increase in interest rates. They hold that when government issues bonds at higher interest rates, it subsequently discourages private sector borrowing, while it entices lenders to move their capital towards government bonds as they are perceived to be less risky and come at a high premium.

3.3.2 Supply side determinants

This sub-section discussed the theoretical determinants of PSCE, from the supply side. The purpose of the section is to describe how each supply side determinant affects private sector credit.

i. Gross domestic product

Apart from having an impact on the demand side, GDP is also regarded as an important positive determinant on the supply side. GDP is arguably a macroeconomic indicator that determines the consumption and production of households and firms respectively. GDP is included as a determinant of private sector credit because it quantifies the country's overall performance, and an improvement thereof would affect credit extension positively (Kalluci & Shijaku, 2013). Damane and Molapo (2017) argue that a contraction in the level of economic activity, measured by GDP, would affect banks' willingness to extend credit because the

production and consumption capacity of firms and households (respectively) is dampened during a slowdown in economy activity and banks, known for being risk adverse, are less willing to extend credit during such times.

ii. Real wage rate

Similarly, real wage rate also has a positive effect on both the demand and supply of credit extension. High wage rates tend to increase the amount available for saving by firms and households. The second-round effect of high savings rates have an amplifying effect on bank deposits, which are converted into credit facilities by financial institutions such as banks (Kalluci & Shijaku, 2013).

iii. Property prices

Hoffmann (2004) argues that the price of a house can influence the assets of a lender in two ways. Firstly, he argues that lenders own assets, and one of the assets that lenders invest in is fixed property, which can affect the ability to raise capital to create loans. Secondly, he contends that the impact can be seen in the deterioration of collateral backed by property with declining values. In addition, he holds that property influences the risk-taking capacities of banks and consequently, their willingness to extend credit. He further holds that house prices may also affect the willingness of banks to lend via balance sheet effects. He pointed out that due to market imperfections – commonly referred to as agency or information asymmetries – households may be credit rationed (borrowing constrained). The private sector can only borrow when they offer collateral (especially within the perceived presence of information asymmetries).

iv. Interest rates

Rashid (2011) holds that high interest rates, which are normally accompanied by high spreads, have a negative correlation with private sector credit. The author argues that financial institutions that depend on taking deposits to create credit are faced with high costs of compensating the depositors and realise low margins when extending credit at prevailing interest rates. The author argues that this will lead to banks reducing PSCE, while an increase in interest rates tends to simultaneously reduce the request for credit by the private sector. The above views are also supported by Hoffman (2004) who argues that the position of

monetary policy indicated by the level of interest rates speaks to the credit worthiness of firms and households and is indicative of their financial position. Hoffman argues that an increase will negatively affect credit supply, while a decrease will positively affect credit supply.

v. Bank deposit

According to Imran and Nishat (2013), bank deposits tend to improve the liquidity of banks, which results in an increase in bank lending. Regulatory reforms of financial markets can induce the private sector to save more, and ultimately their savings are utilised as a source of credit expansion by banks since they lend out deposits. In addition, banking deposits are also identified as a suitable determinant of PSCE because they represent availability of surplus income to the banking system. A high deposit rate implies that there are more disposable funds in the income, and this increases the willingness of a bank to lend because it gives the impression that there are available funds to repay loans in the market (Imran and Nishat, 2013).

vi. Non-performing loans

Non-performing loans (sometimes referred to as loan quality) affects risk aversion of credit providers and represent assets of the bank (Kalluci & Shijaku, 2013). This is a conventional proxy of assessing the loan book of a credit provider or the quality of loans in issue. A deterioration in loan book quality of a bank is seen as a credit risk and discourages credit providers from extending further credit, because a loan book of poor-quality affects profitability. As a result, a rise in the number of non-performing loans results in a drop in credit extension and the opposite would hold.

vii. Liquidity preference by banks

Dow and Rodriguez-Fuentes (1997) state that according to post-Keynesian theory, liquidity and stage of development of a bank are determinants of credit supply. They argue that banks at early phases of development tend to be constrained by low savings or deposit rates and would therefore have little capacity to create credit. In addition, they posit that liquidity preference also determines credit extension in a sense that savers or depositors channel their

savings or deposits towards less risky financial assets, whereas banks also tend to ration credit when liquidity preference rises.

viii. Government deficit (crowding out effect)

Friedman (1978) argues that debt financed fiscal deficit leads to an increase in money supply and subsequently reduces the amount of credit available for investments by the private sector. The author holds that money lending institutions increase advances extended to the government sector and consequently reduce credit extension to the private sector (crowding out effect). The lenders do this because government is seen as a less risky borrower compared to the private sector. Similarly, Carrasco (1998) argues that government deficit leads to high interest expenses and tends to crowd out private sector credit because the private sector borrows less when interest rates are high.

Aschauer (1988) holds that high government spending can result in deficit and when faced with a deficit, government tends to raise debt by issuing bonds. An increase in government bonds comes with an increase in the yield offered by government to the investors. Aschauer points out that when lending institutions invest in government bonds due to the increased yield (interest) and perceived low risk, the size of credit available for extension to the private sector decreases accordingly.

The following table provides a summary of theoretical determinants of private sector credit, from the demand and supply side.

Table 3.1 Summary of theoretical studies on the determinants of private sector credit extension

Determinants of Private Sector Credit Extension		
Demand Side Determinants		
Determinant	Impact on Credit Extension	Reference
Gross Domestic Product	(+)	Afolabi et al. (2012); Hofmann (2004); Imran and Nishat (2013); & Muriu (2016)

Real Wage Rate (Measured by Household Disposable Income)	(+)	Kalluci and Shijaku (2013)
Property Prices	(+)	Hoffman (2004)
Interest Rate (Prime Overdraft Rate)	(-)	Hoffman (2004); Khangaluh (2013); & Muriu (2016)
Inflation	(-)	Beck et al. (2006); Dlamini et al. (2017); & Adeleke and Awodumi (2018)
Debt Service Ratio	(-)	Garcia-Luna, Mohanty and Schnabel (2000)
Real Effective Exchange Rate	(-)	Imran and Nishat (2013); Kalluci and Shijaku (2013); Temesgen (2016); & Muriu (2016)
Public Sector Credit	(-)	Bonga-Bonga and Mabejane (2009); Sacerdoti (2005); Kamaly and Shetta (2014); & Anyanwu et al. (2017)
Supply Side Determinants		
Determinant	Impact on Credit Extension	Reference
Gross Domestic Product	(+)	Kalluci and Shijaku (2013); & Damane and Molapo (2017)
Real Wage Rate	(+)	Kalluci and Shijaku (2013)
Property Prices	(+)	Hoffman (2004)
Interest Rate	(-)	Hoffman (2004); Rashid (2011); & Dlamini et al. (2017)
Bank Deposit	(+)	Imran and Nishat (2013)
Liquidity Preference by Banks	(+)	Dow and Rodriguez-Fuentes (1997)
Non-performing Loans	(-)	Kalluci and Shijaku (2013)
Government Deficit	(-)	Friedman (1978); Carrasco (1998); & Aschauer (1988)

Note: (+) represents a positive impact and (–) represents a negative impact.

3.4 EMPIRICAL LITERATURE ON DETERMINANTS OF PRIVATE CREDIT EXTENSION

This section provides some empirically tested literature covering the determinants of bank credit and other topics related to PSCE. The section is divided into two regions and one country, namely, international, sub-Saharan Africa and South African empirical literature, and concludes with a table summarising the empirical findings.

3.4.1 International empirical literature

Qayyum (2002) analysed the demand for bank lending by private businesses in Pakistan over the period 1960 to 2000. He employed the three-step methodology, which included a univariate analysis, a multivariate cointegration analysis, and an error correction mechanism, and found that production (output) is positively related to PSCE from a demand side perspective. His study also found that interest rates are negatively related to demand for credit. This finding is in line with theory and is supported by Calza et al. (2003) who analysed total loans to the Euro area's private sector over the period 1981 to 2001. The researcher used the cointegration technique and found that loans extended to households and firms are negatively related to interest rates and positively related to real GDP. Lastly, Qayyum further revealed that high rates of inflation lead to a decline in demand for bank credit by business enterprises.

Davis and Zhu (2004) analysed bank lending and commercial property prices at a cross-country level for 17 developed economies over the period 1970 to 1985. They employed a reduced-form theoretical model and found that commercial property prices are positively related to credit extension since they result in credit expansion. The basis for their argument is that declining property prices tend to increase non-performing loans, which leads to a deterioration in the balance sheet of banks and consequently weakens banks' capital adequacies and bases. This subsequently leads to a contraction in credit extension. The above findings are in line with those of Hoffman (2004), who employed the VECM to analyse the determinants of bank credit in industrialised countries over the period 1980 to 1998 and found that GDP and house prices are positively related to bank credit.

Hoffmann (2004) further argued that higher prices may increase the perceived lifetime wealth of borrowers, which will result in an increase in output demanded. Consequently, credit

demand will rise too given that a larger share of loans is secured by property. Lenders usually take a continuity covering mortgage bond (CCMB) to secure loans, thus higher property prices increase the value of assets that can be collateralised and ultimately the credit worthiness of borrowers improves. The above discovery is also consistent with the work of Backe, Egert and Zummer (2006), who employed panel dynamic ordinary least squares (DOLS) to analyse private sector credit in 11 Central and Eastern Europe countries over the period 1975 to 2004. The researchers found that house price increases are parallel, in a robust fashion, with private credit. They further argue that fixed property prices mostly matter for private credit in the event of a possible housing market bubble.

Temin and Voth (2004) analysed credit rationing and crowding out in England over the period from 1702 to 1862. The researchers employed the Vector Autoregressive (VAR) estimates and discovered that advances to the government (public sector credit) are negatively related to PSCE. This finding is in line with theory, which posits that banks prefer to extend credit to the government as they are viewed as less risky borrowers and provide a safe haven for their investment. On the other hand, some authors argue that an increase in demand for loans by the public sector increases borrowings and crowds out private sector credit (Sacerdoti, 2005; Bonga-Bonga & Mabejane, 2009; Kamaly & Shetta, 2014; Anyanwu et al., 2017).

Backe, Egert and Zummer (2006) analysed private sector credit in 11 Central and Eastern Europe countries. They employed panel DOLS and discovered that a rise in credit extended to the public sector, resulting in a decrease in credit extended to households and firms (the so-called crowding out effect). They argue that this discovery is common for emerging market economies. They also discovered that an increase in financial liberalisation is positively related to private credit extension in small Organization for Economic Cooperation and Development (OECD) countries. In addition, they found that nominal interest rates are negatively related to private credit extension in emerging markets and small OECD member countries.

Their study further revealed that nominal interest rates are negatively related to private sector credit in certain parts of Central and Eastern Europe. Their analysis also found that interest rates are positively related to credit extension in Baltic States and other parts of Central and Eastern Europe. They argued that this could be a result of differing monetary

policy and lending processes in each region of Europe. In addition, their study found that inflation is strongly negatively related to private sector credit. Lastly, financial liberalisation was found to be positively related to credit extension in Baltic States and other parts of Central and Eastern Europe.

Chakraborty (2006) analysed fiscal deficits, capital formation and crowding out in India over the period 1970 to 2003. The author employed the Asymmetric Vector Autoregressive model (AVAR) and found that government budget deficit is negatively related to PSCE.

Djankov et al. (2007) analysed private sector credit in 129 countries over the period 1978 to 2003. The researchers employed a qualitative method (survey) and found that an important determinant of credit extension is legal creditor rights and information sharing intuitions. This finding is relatable in the South African formal credit market as lending institutions rely more on credit sharing information institutions such as Experian, XDS, Compuscan and Transunion to confirm payment history, defaults, and total exposure of a borrower before extending more credit.

Karlan and Zinman (2008) conducted a study on credit elasticities in 86 developing economies over the period from 2003 to 2006. The researchers employed a qualitative approach (randomised trials) and found that interest rate increases are negatively related to credit demand. The researchers argue that interest rate increases tend to dwarf repayments and consequently makes it difficult for borrowers to seek credit. On the one hand, they reported that micro lenders are prescribed to increase rates to eliminate reliance on subsidies (to maintain sustainability because of increased revenue). On the other hand, commercial banks are presumed to increase interest rates in efforts to ration credit demanded by sub-prime borrowers.

Nieto (2007) investigated the determinants of household credit in Spain over the period 2003 to 2006. The author used a single equation Error Correction Model (ECM) and found that household credit is positively related to consumption, wealth, and repayment terms. His study, however, found that credit is negatively related to borrowing costs and unemployment. These findings are in line with theory, which explains that the costs of borrowing discourage credit demand as they increase the cost of loans, and lenders are cautious of extending credit in a country characterised by high unemployment rates. Nieto also discovered that, in the short run, credit is negatively related to long-term government

debt. He argues that government debt is indicative of how interest rates and general economic activity are evolving, which entices households to demand more credit.

Sogut (2008) analysed the determinants of financial development and private sector credit in 85 developing and industrial countries over the period 1980 to 2006. Sogut used a panel cross-sectional fixed effects methods and found that an increase in credit to the public sector is negatively related to PSCE in low and lower middle-income countries. The researcher also found that, for upper middle-income and high-income countries, public sector credit is positively related to private sector credit.

Emran and Farazi (2009) examined government borrowing and private sector credit in 60 developing countries over the period 1975 to 2006. The researchers employed the bound testing technique and found that public sector credit extension is negatively related to PSCE. The researchers found that one US dollar extended to the public sector reduces private sector credit by one dollar forty cents.

Le and Nguyen (2009) analysed the impact of networking on bank financing in Vietnam over the 2005 period. The researchers used a qualitative survey technique and found that businesses that have a strong network with third parties are less likely to borrow from formal financial institutions (demand determinants). The researchers argue that the process of obtaining bank loans is contentious and compels business owners to exploit the network they have with their suppliers whenever they require credit. The business owners also tap into their extended network by way of trying to borrow from their customers, members of social organisations, friends, and family members as alternative sources of raising funds. This finding is mostly common in low-income and middle-income countries such as South Africa, and usually takes place in informal or very small businesses where capital is raised through friends and family.

Eller et al. (2010) employed the Markov-Switching Error Correction Model (MS-ECM) to analyse long-run (from a demand side) and short run (from a supply side) determinants of private sector credit in 11 Central, Eastern and Southeastern Europe (CESEE) countries over the period 1997 to 2009. Their study revealed that inflation is negatively related to lending. This finding is in line with theory because inflation leads to high interest rates aimed at discouraging spending and encouraging saving. Their study also revealed that interest rates

are positively related to credit extension. The researchers argue that in certain parts of CESEE this positive relationship is a result of reverse causality. They further contend that a priori holds that a high interest rate is accompanied by a decrease in credit demand. In addition, they argue that due to the reverse impact, a strong demand for credit is resulting in banks increasing interest rates with an aim of maximising profits. From a supply side, their study revealed that bank deposits result in an increase in PSCE in some parts of CESEE.

The findings of Eller et al. are in line with a priori as bank deposits tend to improve capital adequacy of banks. In South Africa, banks are required by the South African Reserve Bank to hold 2,5% as a reserve requirement and can lend out the rest using the money multiplier as a tool to determine how much money they can lend against their deposit or capital base.

Al Daia et al. (2011) analysed the determinants of credit to the private sector in 22 countries of the Arab League from a demand side, over the period 1995 to 2006. The researchers used the pooled least squares method and discovered that credit to the private sector is positively related to GDP. The researchers hold that this finding is in line with theory, which states that as more firms and individuals demand more credit during an upward trend in economic activity and in correspondence with an expansion in economic activity, more individuals and firms try to seize more opportunities during great economic times. This finding is in line with an earlier finding by Hoffman (2004) who also found that GDP is positively related to private sector credit.

Contrary to a priori and theoretical expectations, the study of Al Daia et al. further found that credit to households and firms is positively related to interest rates. They argue that this is due to high costs incurred by borrowers when they borrow from other or alternative sources of financing in the economy. A perfect example of alternative sources of financing is micro finance institutions. On the other hand, their analysis established a negative relationship between credit to the private sector and export concentration. The above-mentioned researchers further argue that this is because more concentrated economies tend to provide the lowest levels of credit to household and firms. This phenomenon is attributed to credit rationing.

Ali et al. (2011) analysed sensitivity of domestic credit to the private sector in Pakistan over the period 1980 to 2009. They employed the ECM and found that there is a prevalence of a

crowding in and out effect between government borrowing and private sector credit. Their study established that the more government borrows for non-development expenditure, the more credit to the private is reduced.

Guo and Stepanyan (2011) analysed the determinants of bank credit in 38 emerging market countries over the period 2001 to 2010. They employed the rich time series and cross-sectional methods and found that GDP is positively related to private sector credit. The authors also found that bank deposits are positively linked to private sector credit. Interestingly, their study further revealed that inflation is positively related to private sector credit.

Ee et al. (2012) analysed the macroeconomic determinants of bank credit in Malaysia over the period 1991 to 2011. They employed the ECM and found that a rise in interest rates is positively related to an increase in credit extended to the private sector. Inflation was also found to be positively related to PSCE. Both findings contradict theory and a priori, which states that interest rates are usually increased to curb inflation and in turn, discourages spending and ultimately decreases credit demanded by borrowers. Lastly, their study also found GDP to be positively related to credit extension.

Beer and Waschiczek (2012) employed the bank lending survey and the Bayesian model to analyse corporate loan development in Austria over the period 2002 to 2011. Their study found that credit extension reacts to changes in demand factors, while supply factors only play an insignificant role in influencing credit extended to household and firms. The findings of their study contradict theoretical arguments by their counterpart, Cuningham (2006), who conducted a survey on the predictive power of the senior loan officer in Atlanta and established that credit standards (a variable from the supply side of credit) have a significant influence on loan development from demand factors. Meanwhile, Runde (2001) also argued that the decision to lend is based on the beliefs a lender has about the creditworthiness of a potential borrower.

Gounder and Sharma (2012) investigated the determinants of bank credit in small open economies (six Pacific Island countries) over the period 1982 to 2009. They used both time series and cross-sectional panel data and found that interest rates and inflation are negatively

related to private sector credit. In line with theoretical expectations, their study also revealed that economic growth (GDP), bank deposits and bank assets are positively related to PSCE.

Abo and Ghimire (2013) analysed Ivorian SMEs' access to credit from a demand side and supply side perspective over the 2012 period. They employed the probability sampling, cross-tabulation, and correspondence analysis techniques, and found that information asymmetries and inadequate collateral are some of the factors that discourage borrowers from demanding credit from the formal sector in Ivory Coast. The above findings contrast with findings by Gebrekiros (2013), who later analysed the determinants of credit rationing of SMEs in Ethiopia over the 2013 period. Gebrekiros used a multinomial Logit model and found that collateral does not have an impact on credit extension, from a supply side. This means that Ethiopian lenders are willing to extend credit to borrowers with little or no collateral at all.

Imran and Nishat (2013) analysed the determinants of bank credit in Pakistan from a supply side approach over the period 1971 to 2010. They employed the ARDL model and found that foreign liabilities, domestic deposit, economic growth, exchange rate and monetary conditions of Pakistan are positively related to PSCE. On the other hand, inflation and money market rates were discovered to be negatively related to PSCE from a supply side perspective. The finding on inflation is in support of earlier findings by Gounder and Sharma (2012).

Ahmed and Cheng (2014) analysed the demand for credit, credit rationing and the role of micro finance in China over the 2005 period. They used a linear probability model and found that households headed by women in rural China are credit rationed as opposed to households headed by men. They further reported that households with a low dependency ratio have greater access to credit, whereas those with high dependency ratios are susceptible to credit rationing. On the one hand, their study also revealed that education and age of household heads is positively related to credit extension. On the other hand, informal lenders have been found to not credit ration individuals based on their level of education and age.

Crocco et al. (2014) investigated the determinants of credit availability in Brazil over the period 1999 to 2008. They used a generalized method of moments (GMM) with dynamic panel data and found that a decrease in the liquidity of banks is positively related to credit.

They further revealed that an increase in GDP results in an increase in credit extension, as it reduces uncertainty of agents and confirms the optimistic expectation of the future. The authors argued that liquidity preference of both banks and the public plays an important role in determining credit extension. Lastly, the authors used access to a banking system as a measure and found that it is positively related to an increase in credit extension.

Kalluci and Shijaku (2014) analysed the determinants of bank credit to the private sector in Albania: a demand and supply side approach over the period 2001 to 2004. They employed the VECM and found that GDP is positively related to PSCE. The researchers argue that higher growth rates enhance the confidence of borrowers regarding the economy and subsequently makes them believe that high economic activity implies their improved ability to repay loans. This tends to increase credit demand. On the other hand, they found that net real wages are negatively related to credit demand. In addition, their study revealed that bank deposits and financial intermediation are positively related to credit extension. Furthermore, their study also found real effective exchange rate to be positively related to credit extension. The researchers argue that net importing countries tend to require more credit to finance their investments. Lastly, the researchers found that there is an existence of a crowding in and out between public and PSCE. They argued that a decrease in public debt results in a rise in credit available to the private sector.

The above finding on the public and private sector crowding out effect is in line with that of Kamaly and Shetta (2014), who analysed the crowding out effect between budget deficit private credit in Egypt over the period 1970 to 2009. Kamaly and Shetta used a VAR and found that as government issues out more debt instruments to finance its deficit, banks shift funds available to the private sector, towards less risky portfolios. According to the researchers, bank's view government debt instruments as less risky. The researchers further argued that a shift from risky lending portfolios to less risky portfolios reduce private investment as credit available to the private sector is being rechanneled towards government debt, which consequently reduces overall economic output or activity.

Pham (2015) examined the determinants of bank lending in 146 developing countries over the period 1990 to 2013. He used panel data analysis and found that bank deposits are negatively related to credit extension, while interest rates were found to be positively related

to credit extension. Pham also revealed that capital adequacy requirements are negatively related to credit extension from a supply side perspective. The researcher argues that there is a trade-off between solvency requirements and loan supply by lending institutions. He proceeds to note that an increase in money required to be held as reserves reduces funds available for credit extension. In addition, Pham found inflation to be negatively related to credit extension. He argues that the rationale behind this finding is that firms and households are less willing to engage in long-run financial projects in a high inflationary environment. Lastly, his study established that exchange rate is negatively related to credit extension. He argues that an improvement in domestic currency reduces exports and subsequently reduces credit demand.

Bhattarai (2016) analysed the determinants of lending behaviour in Nepalese commercial banks from a supply side over the period 2007 to 2014. He employed the pooled data regression technique and found that bank size is positively related to credit extension. On the other hand, liquidity, investment portfolio and cash reserve requirement were found to be negatively related to private credit extension. The finding on bank size is in support of an earlier finding by Gounder and Sharma (2012).

Laidroo (2016) analysed bank ownership and lending in Central and Eastern European over the 2004 period. The researcher employed the fixed effects model and two step GMM and found that bank size is negatively related to loan growth. He believes that with specific reference to CEE, this could be due to a higher level of relationship lending**.** He proceeds to argue that this could be because infant banks in CEE were able to exhibit greater loan growth because of their very low base values, whereas larger banks loan portfolios were already so big that their loan books could not reach high levels of growth. Lastly, his study found that liquidity ratio is positively related to credit extension. He has acknowledged that this discovery is in stark contrast to the findings of earlier research findings by Jackowiez and Kowalewski (2013), Temesgen (2016) and Bhattarai (2016).

Anyanwu et al. (2017) analysed government domestic debt, private sector credit and the crowding out effect in 28 oil-dependent countries over the period 1990 to 2012. The researchers used both the fixed effects and generalized method of moment's estimation and found that government borrowing is negatively related to private sector credit. This finding is

in support of an earlier finding by Temin and Voth (2004), who analysed credit rationing and crowding out in England.

Bhattarai (2019) analysed the determinants of commercial banks' lending behaviour in Nepal over the period 2012 to 2018. He used a linear regression approach and found that inflation is positively related to credit extension. He further revealed that interest rates are negatively related to PSCE. Conversely, Da Chuna et al. (2020) analysed the determinants of South American bank credit over the period 2000 to 2016. Da Chuna et al. employed the fixed effect panel method and random effects method and found that inflation is negatively related to private sector credit. The authors further found that bank deposits and GDP are positively related to PSCE. Similarly, Hamua et al. (2020) analysed the determinants of private sector credit in Papua Guinea over the period 2000 to 2017. Hamua et al. employed the ARDL technique and found that bank deposits, GDP and real effective exchange rate are positively related to PSCE.

3.4.2 Sub-Saharan Africa empirical literature

Bousrih et al. (2007) analysed the impact of debt relief on private sector credit in 52 African countries over the period 1988 to 2004. They used the fixed effects and GMM system estimator and found that debt relief is positively related to PSCE. Their study further revealed that interest rates are positively related to private sector extension. On the one hand, this is line with theory from a supply side of credit, which states that lenders see rising interest rates as an opportunity to improve their balance sheet due to the high interest income. On the other hand, this contradicts theory from a demand side of credit, given that increasing interest rates result in high borrowing costs, which subsequently reduces credit demand by borrowers. This finding is in line with an assertion by Christensen (2004), who argued that debt relief alleviates domestic debt and creates room for domestic credit for both public and private sectors in the absence of crowding in and out effects.

Lastly, the study of Bousrih et al. also found fiscal deficit to be negatively related to PSCE. This finding is supported by theory which holds that, from a supply side of PSCE, fiscal deficit is accompanied by the amount of financing a government seeks from the banking system. Banks see a fiscal deficit as an opportunity for a safe investment of their deposit base. Consequently,

this raises interest rates and reduces the amount of resources channeled to the private sector, for credit extension to take place (Sacerdoti, 2005).

Akpansung and Babilola (2011) analysed banking sector credit and economic growth in Nigeria over the period 1970 to 2008. The researchers used the Granger causality and Two-stage Least Squares (TSLS) and found that GDP is positively related to private sector credit. Their study revealed that an 86% growth rate in GDP is the result of a 1% increase in PSCE. This finding on GDP is supported by Olokoyo (2011), who analysed the determinants of commercial banks' lending behaviour in Nigeria over the period 1980 to 2005. Olokoyo used the VECM and found that real effective exchange rate and GDP are positively related to private sector credit. He further found that interest rates are positively related to private sector credit, which contrasts with what theory dictates.

Chukwuemeka et al. (2012) analysed the determinants of lending behaviour of commercial banks in Nigeria over the period 1975 to 2010. The researchers used a cointegration analysis and found that bank credit is positively related to bank deposits, real effective exchange rate and GDP, and negatively related to interest rates. The finding on real effective exchange rate is in support of an earlier finding by Olokoyo (2011). Meanwhile, the finding on interest rate contradicts an earlier finding by Olokoyo (2011), who found that interest rate is positively related to bank credit.

Arsene and Guy-Paulin (2013) analysed the nexus between credit to the private sector, inflation, and economic growth in Cameroon over the period 1965 to 2010. They employed the VAR model and found that private sector credit is positively related to economic growth and inflation. The finding on GDP is in support of earlier findings by Akpansung and Babilola (2011) and Olokoyo (2011).

Mbate (2013) analysed domestic debt, private sector credit and economic growth in 22 sub-Saharan Africa countries over the period 1985 to 2010. He used the system-GMM and discovered that domestic debt crowds out PSCE. Mbate argued that this deters capital accumulation and hinders private sector credit growth. This discovery is in line with an earlier finding by Ali et al. (2011), who analysed sensitivity of domestic credit to the private sector in Pakistan and established that government borrowing crowds out private sector credit.

Ayano (2014) analysed the determinants of domestic credit to the private sector in Ethiopia over the period 1981 to 2011. The researcher used the VECM and found that GDP is positively related to private sector credit. On the other hand, interest rates were found to be negatively related to private sector credit. The finding on GDP is in line with an earlier finding by Akpansung and Babilola (2011), Olokoyo (2011) and Arsene and Guy-Paulin (2013), while the finding on interest rate contrasts with an earlier finding by Olokoyo (2011) and is in line with an earlier finding by Chukwuemeka et al. (2012).

Assefa (2014) analysed the determinants of growth in bank credit to the private sector in Ethiopia from the supply side, over the period 1978 to 2011. The researcher employed the ARDL method and found that bank deposit, foreign liabilities, interest rate, GDP and inflation were positively related to private sector credit. Money supply was found to be negatively related to private sector credit. The finding on interest rate is in line with an earlier finding by Olokoyo (2011) and contrasts with an earlier finding by Ayano (2014) and Chukwuemeka et al. (2012). The findings on inflation and GDP are in line with earlier findings by Arsene and Guy-Paulin (2013).

Arene and Essien (2014) analysed access to credit by SMEs in Nigeria over the 2012 period. They used the Logit model and found that the level of education is positively related to credit extension. Their study revealed that, at 10% level of significance, the higher the level of education, the higher the likelihood of accessing credit in the formal sector. They further reported that entrepreneurs with the highest form of education are more enlightened and more likely to access credit than those with low levels of education. Arene and Essien also found that enterprise size is positively related to credit extension. Their study further discovered that the likelihood of obtaining credit increases with the age of an enterprise. Lastly, their study established that every increase in assets of an enterprise is followed by a proportionate increase in the likelihood of obtaining formal credit. The authors noted that the finding on the size of a business is refuted by some researchers who argue that the size of a firm is viewed as a reverse proxy for the probability of bankruptcy, which makes lenders more willing to extend credit to sizeable firms as opposed to small firms.

Agbekpornu and Opoku-Mensah (2015) analysed the determinants of access to credit in Ghana over the 2013 period. They employed the Logit model and found that collateral is

positively related to credit extension. This discovery is in line with an earlier finding by Arene and Essien (2014), who found that borrowers with valuable assets such as property, obtain credit with ease as the assets are viewed as collateral by lending institutions.

Akinlo and Oni (2015) analysed the determinants of bank credit growth in Nigeria over the period 1980 to 2010. They employed the ECM technique and found that interest rates are negatively related to private sector credit. The same study also found inflation to be positively related to private sector credit growth. The finding on interest rate is supported by earlier findings by Chukwuemeka et al. (2012) and Ayan (2014) and is in contrast with earlier findings by Bousrih et al. (2007), Olokoyo (2011) and Assefa (2014).

James (2015) analysed the determinants of commercial banks' credit to the private sector in Uganda over the period 1997 to 2013. James employed the Engle and Granger two step estimation technique and found that bank deposits are positively related to private sector credit. In addition, public sector credit or credit to the government was discovered to be negatively related to PSCE. The finding on bank deposit is in support of earlier findings by Chukwuemeka et al. (2012) and Assefa (2014).

Mwigeka (2015) analysed budget deficit and private investments in Tanzania over the period 1970 to 2012. He employed the VECM and found that budget deficit is negatively related to private sector investment, which ultimately leads to households and firms reducing their demand for credit. This is in line with an earlier finding by Bousrih et al. (2007), who also found fiscal deficit to be negatively related to private sector credit.

Muriu (2016) analysed factors influencing the demand for credit in Kenya over the period 1980 to 2012. Muriu employed the VECM and found that interest rates are positively related to private sector credit. The author highlighted that contrary to theory, the private sector of Kenya demands more credit when interest rates are high. In addition, the author found that economic growth and exchange rate are negatively related to PSCE. The finding on exchange rate is in line with earlier findings by Olokoyo (2011) and Chukwuemeka et al. (2012).

Temesgen (2016) analysed determinants of banks' lending behavior in Ethiopia over the period 2004 to 2013. He used the fixed effect model and found interest rate to be positively related to bank lending. Foreign exchange was found to be negatively related to bank lending.

Temesgen argued that it is a result of the depreciation of domestic currency, which leads to a decline in loans and advances. In addition, he found that bank capital is negatively related to bank lending. He also argued that this is a main determinant given that Ethiopian banks put a lot of capital aside, as statutorily required. He proceeds to report that capital must equal 8% of the total amount of risk-weighted assets (solvency test in Ethiopia).

Temesgen further revealed that credit risk is negatively related to bank lending because its important characteristics, non-performing loans (NPL), affect the lending capacity of commercial banks. He noted that this is because higher NPL reduces the bank's income and balance sheet, which has a consequence of reducing loan supply. He also reports that liquidity ratio is negatively related to bank credit. He argues that this is due to banks preferring to hold a high amount of assets that can easily be transformed into cash at a lower cost, and because they are obligated to pay depositors at any time – that is, fear of a deposit run. Lastly, his study revealed that deposits are positively related to bank lending given that banks lend out deposits. The bigger the deposit, the bigger the advances can be made from those deposits because of the multiplier effect on money supply.

Damane and Molapo (2017) analysed private sector credit in Lesotho over the period 2005 to 2014. They employed an ARDL approach, which revealed the existence of a positive relationship between credit extension to the private sector and bank deposits. They also found that net foreign assets of banks are negatively related to credit extension in Lesotho. The researchers substantiated this finding by referencing a report by the Central Bank of Lesotho (2012), which outlined that Lesotho's commercial banks are highly liquid and hold large portfolios of interest-bearing instruments. This is in line with an earlier assertion by Sacerdoti (2005), who pointed out that sub-Saharan banks are highly liquid. Lastly, their study revealed that non-performing loans are an insignificant determinant of credit extension in Lesotho.

Adeleke and Awodumi (2018) analysed bank credit supply determinants in Nigeria over the period 1970 to 2015. They used the ARDL and found that, in the long run, exchange rate, money supply, net foreign liabilities and GDP are positively related to PSCE, from a supply side perspective. Their study also found that inflation is negatively related to PSCE. This finding bodes well with economic theory and a priori as noted in our earlier section of literature review. By contrast, Katusiime (2018) analysed private sector credit and inflation volatility in

Uganda over the period 1975 to 2017. He used the ordinary least squares (OLS) and found that inflation is positively related to PSCE.

Hakwashika (2018) analysed the relationship between PSCE and economic growth in Namibia over the period 2005 to 2017. He employed the cointegration and error correction techniques and found that there is a positive relationship between GDP and PSCE.

Lastly, Mallinguh and Zoltan (2018) analysed domestic credit to the private sector by banks within four East African economic blocks over the period 2013 to 2016. The researchers used the ECM and found that inflation is negatively related to PSCE. This finding contradicts earlier findings by Arsene and Guy-Paulin (2013) and Assefa (2014), who found inflation to be positively related to PSCE. Conversely, Adegbenle et al. (2020) later analysed monetary policy and bank lending in Nigeria over the period 1980 to 2018. The researchers used the ARDL technique and found that inflation and interest rates are negatively related to credit extension. Meanwhile, they found real effective exchange rate to be positively related to credit extension.

3.4.3 South African empirical literature

Clarke and Cull (2006) analysed access to credit and firm ownership in South Africa – a supply side approach, over the 2005 period. They employed a two-limit Tobit model and found that race has an impact on whom credit is extended to. Most black owned firms reported that the main challenge was accessing credit, whereas white owned firms cited high interest rate as a reason for not utilising bank credit facilities. White owned firms reported that they were not credit constrained, while black owned firms argued that they are being credit rationed. Their study also reported that the size and age of a firm are positively related to credit extension in a sense that bigger and older firms can obtain credit with ease. However, small, and infant firms reportedly find it difficult to obtain credit from financial institutions.

Bbenkele (2007) analysed SMEs' perception towards services offered by commercial banks in South Africa over the 2007 period. Bbenkele used a qualitative survey technique and found that, from a demand side viewpoint, SMEs situated in rural areas find bank loans and the process to acquire one as ineffective. He attributed this to the owners' lack of collateral and lack of understanding of how banks' credit extension process works in urban areas. The above finding is supported by Clark and Cull (2006) and Okurut (2010), who established that firms

located in urban areas have a better chance of obtaining credit than firms situated in rural areas. Moreover, the above researchers found that lack of education also plays a pivotal role in a business owner's ability to obtain credit. Conversely, Bbenkele found that SMEs situated in urban areas find bank loans to be useful and more accessible than their rural counterparts.

Lack of professional financial records was also identified as a serious barrier to access to credit. SMEs without proper financial records demanded little credit if any credit at all. On the supply side, Bbenkele found that information asymmetries by business owners discourage banks from lending without following rigorous credit assessment processes. This makes banks follow a more prudential approach when assessing credit applications of SMEs.

The above finding is in line with the moral hazard theoretical framework, which states that one party gets involved in a risky transaction with the knowledge that it bears less or no risk than the other party should the transactions fail. In this case, the borrower hides the true picture of financial performance – which is usually reflected in financial records – and subsequently limits the lender from making a full assessment based on the risk and prospects of the business (usually confirmed through cash flow projections). It is noteworthy to contend that the adverse selection theory also holds where lack of financial records leads to banks failing to extend credit without challenges. The theory states that one party (usually a seller, and in this case, a lender) to a transaction has more relevant knowledge about the other, than the other way around. In a credit extension scenario, the lender has more information about SMEs' failure, cash flow constraints and industry risk than the borrower has due to lack of knowledge (education) and proper records that depict the full picture of a business.

Fatoki and Odeyemi (2010) investigated the determinants of access to trade credit by new SMEs in South Africa over the 2009 period. They used a logistic regression model and discovered that property as a form of collateral – which is a factor influencing the decision by finance houses when credit extension is being considered – is not a considerable determinant of access to credit in South Africa. Their study furthers suggests that businesses managed by educated and experienced individuals are more likely to access credit. They further discovered that location of a business, availability of business plans and business insurance improves the chances of success with credit applications.

Okurut (2010) examined access to credit by poor households of South Africa over the period 1995 to 2000. The researcher used the multinomial Logit and Heckman probit models and found that access to bank credit is positively related to age, gender, race (white), household size, education, and household per capita. This study will not include these variables due to the lack of adequate statistical data covering the period of the study. Okurut also found that gender, location, economic status, and race (black) are negatively related to access to credit from a supply side perspective.

Fatoki and Smit (2012) conducted a study that focused on debt financing to small new enterprises in South Africa over the 2009 period. They used a quantitative research design and survey method and found that the inefficiency of the legal system is correlated with the lack of available credit from trade creditors. Similarly, their study also revealed that credit providers cited the poor legal system as a reason to ration credit due to little recourse from a legal point of view when a lender must collect on a defaulted debt. This finding is based on the view that credit legal requirements and collateral explain the rejections of credit applications.

Chimucheka and Rungani (2013) conducted a study that focused on obstacles to accessing finance by SMEs in South Africa over the 2013 period. They used a triangulation research design and found that, among others, lack of financial deposit, poor business plan, business idea not being viable, no loans to foreigners, and lack of collateral were the most common reasons why banks are not willing to extend credit to SMEs. By contrast, Fatoki (2014) extracted data from four big banks of South Africa, and he reported his finding from Nedbank's requirements for a loan to be granted, which included collateral. He pointed out that many small businesses lack assets to put up as security for bank loans. He proceeded to report that, to partly resolve the obstacle that collateral requirements bring to the credit market, Khula (government's small business finance agency) offers SMEs a credit guarantee scheme.

Agwa-Ejon et al. (2015) analysed financial obstacles faced by SMEs in South Africa over the 2015 period. They used a probability sampling method (survey and questionnaire) and found that lack of understanding of the bank's credit extension process was the main reason for borrowers demanding less credit as opposed to enterprises that have a better understanding

of how the credit extension process works. He attributes information asymmetries as the reason behind this conundrum. The work on lack of understanding and information asymmetries is backed by Mutezo (2013), who argued that information asymmetries do play a pivotal role from a credit supply side. Mutezo argued that SMEs cannot supply the information required by lending institutions when credit is being requested by the potential borrowers. Furthermore, Mutezo argues that SMEs struggle to obtain credit from financial institutions due to lack of understanding of how credit extension and the loan process works.

Muzinduti and Nhlapho (2017) analysed the effects of country risk on credit extension in South Africa over the period 1995 to 2015. The authors employed the ARDL model and the Toda-Yamamoto approach of the Granger causality test and found that there is a negative relationship between country risk and credit extension. The authors argue that this discovery is in line with a priori, which states that a high-risk country, coupled with high-risk industries and negative economic outlooks, discourages lenders from opening their credit taps.

Lastly, Akinsola and Ikhide (2019) employed the VAR model to analyse bank credit to SMEs in South Africa. Their study covered the period 2008 to 2014 and found that business cycle is positively related to bank credit to SMEs. The researchers established that there is evidence of procyclicality between business cycle and SME credit in South Africa. Their study further revealed that many banks decrease lending during bad economic times and vice versa during good times. The researchers noted that the inverse relationship is ascribed to the capital adequacy requirement by the SARB emanating from the Basel's recommendation on capital adequacy requirements.

The following table provides a summary of empirical findings from an international, sub-Saharan Africa and South African perspective.

Table 3.2 Summary of international and sub-Saharan Africa empirical literature

Author	Region/Country	Method	Study period	Impact of determinant on private sector credit extension
International Evidence				
Qayyum (2002)	Pakistan	Three-step methodology (univariate analysis, a multivariate cointegration analysis, and an error correction mechanism)	1960-2000	• Production (+) • Interest rates (-) • Inflation (-)

Calza et al. (2003)	Euro Zone	Cointegration technique	1981-2001	• Interest rates (-) • Gross domestic product (+)
Davis and Zhu (2004)	17 Developed countries	Reduced-form theoretical model	1970-1985	• Property prices (+)
Hoffman (2004)	Industrialised countries	VECM	1980-1998	• Property prices (+) • Gross domestic product (+)
Temin and Voth (2004)	England	VAR	1702-1862	• Public sector credit (-)
Backe, Egert and Zummer (2006)	11 Central and Eastern Europe countries	ECM & DOLS	1975-2004	• Property prices (+) • Public sector credit (-) • Financial liberalisation (+) • Interest rates (+/-)
Chakraborty (2006)	India	AVAR	1970-2003	• Budget deficit (-)
Djankov et al. (2007)	129 Countries	Qualitative method (survey)	1978-2003	• Legal creditor rights (+) • Information sharing intuitions (+)
Karlan and Zinman (2007)	86 Less developed economies	Qualitative approach (randomised trials)	2003	• Interest rates (-)
Nieto (2007)	Spain	Single equation ECM	2005-2006	• Consumption (+) • Wealth (+) • Repayment terms (+) • Interest rates (-) • Unemployment (-) • Government debt (-)
Sogut (2008)	85 Developing and industrial countries	Panel cross-sectional fixed effects methods	1980-2006	• Public sector credit (+/-)
Emran and Farazi (2009)	60 Developing countries	Bounds testing technique	1975-2006	• Public sector credit (-)
Le and Nguyen (2009)	Vietnam	Qualitative survey technique	2005	• Networking (+)
Eller et al. (2010)	11 Eastern and Southeastern Europe	MS-ECM	1997-2009	• Inflation (-) • Interest rates (+) • Bank deposits (+)
Al Daia et al. (2011)	22 countries of the Arab League	Pooled least squares	1995-2006	• Gross domestic product (+) • Interest rates (+) • Export concentration (-)
Ali et al. (2011)	Pakistan	ECM	1995-2006	• Public sector credit (-)
Guo and Stepanyan (2011)	38 Emerging market countries	Rich time series and cross-sectional methods	2001-2010	• Gross domestic product (+) • Bank deposits (+) • Inflation (+)
Ee et al. (2012)	Malaysia	ECM	1991-2011	• Interest rates (+) • Inflation (+) • Gross domestic product (+)

Gounder and Sharma (2012)	Six Pacific Island countries	Time series and cross-sectional panel	1982-2009	• Interest rates (-) • Inflation (-) • Bank deposits (+) • Gross domestic product (+)
Abo and Ghimire (2013)	Ivory Coast	Probability sampling, cross-tabulation and correspondence analysis techniques	2012	• Information asymmetries (-) • Collateral (-)
Imran and Nishat (2013)	Pakistan	ARDL	1971-2010	• Foreign liabilities (+) • Bank deposits (+) • Gross domestic product (+) • Exchange rate (+) • Monetary conditions (+) • Inflation (-) • Money market rates (-)
Ahmed and Cheng (2014)	China	Linear probability model	2005	• Gender (+/-) • Dependency ratio (-) • Education (+) • Age of household heads (+)
Crocco et al. (2014)	Brazil	GMM	1999-2008	• Liquidity of banks (+) • Gross domestic products (+)
Kalluci and Shijaku (2014)	Albania	VECM	2001-2004	• Gross domestic products (+) • Real wage rate (-) • Bank deposits (+) • Financial intermediation (+) • Real effective exchange rates (+) • Public sector credit (-)
Kamaly and Shetta (2014)	Egypt	VAR	1970-2009	• Public sector credit (-)
Pham (2015)	146 Developing countries	Panel data analysis	1990-2013	• Bank deposits (-) • Interest rates (+) • Capital adequacy requirements (-) • Inflation (-) • Real effective exchange rate (-)
Bhattarai (2016)	Nepal	Pooled data regression technique	2007-2014	• Bank assets (+) • Liquidity (-) • Investment portfolio (-) • Cash reserve requirement (-)
Laidroo (2016)	11 Central and Eastern European countries	Fixed effects model and two step GMM	2004	• Bank assets (-) • Liquidity ratio (+)
Anyanwu et al. (2017)	28 Oil-dependent countries	Fixed effects and GMM	1990-2012	• Public sector credit (-)
Bhattarai (2019)	Nepal	Linear regression	2012-2018	• Inflation (+) • Interest rates (-)
Da Chuna et al. (2020)	South America	Fixed effect panel method and random effects method	2000-2016	• Inflation (-) • Bank deposits (+) • Gross domestic product (+)
Hamua et al. (2020)	Papua Guinea	ARDL	2000-2017	• Bank deposits (+) • Gross domestic product (+) • Real effective exchange rate (+)

Sub-Saharan Africa				
Bousrih et al. (2007)	52 African Countries	Fixed effects and GMM	1988-2005	• Debt relief (+) • Interest rates (+) • Fiscal deficit (-)
Akpansung and Babilola (2011)	Nigeria	Granger causality and Two-stage Least Squares	1970-2008	• Gross domestic product (+)
Olokoyo (2011)	Nigeria	VECM	1980-2005	• Real effective exchange rate (+) • Gross domestic product (+) • Interest rates (+)
Chukwuemeka et al. (2012)	Nigeria	Cointegration analysis	1975-2010	• Bank deposits (+) • Real effective exchange rate (+) • Gross domestic product (+) • Interest rates (-)
Arsene and Guy-Paulin (2013)	Cameroon	VAR	1965-2010	• Gross domestic product (+) • Inflation (+)
Mbate (2013)	21 Sub-Saharan Africa countries	System GMM	1985-2010	• Public sector credit (-)
Ayano (2014)	Ethiopia	VECM	1981-2011	• Gross domestic product (+) • Interest rates (-)
Assefa (2014)	Ethiopia	ARDL	1978-2011	• Bank deposit (+) • Foreign liabilities (+) • Interest rate (+) • Gross domestic product (+) • Inflation (+) • Money supply (-)
Arene and Essien (2014)	Nigeria	Logit model	2012	• Education (+) • Business size (+) • Age of a business (+) • Business assets (+)
Agbekpornu and Opoku-Mensah (2015)	Ghana	Logit model	2013	• Collateral (+)
Akinlo and Oni (2015)	Nigeria	ECM	1980-2010	• Interest rates (-) • Inflation (+)
James (2015)	Uganda	Engle and Granger two step estimation technique	1997-2013	• Bank deposits (+) • Public sector credit (-)
Mwigeka (2015)	Tanzania	VECM	1970-2012	• Fiscal deficit (-)
Muriu (2016)	Kenya	VECM	1980-2012	• Interest rates (+) • Gross domestic product (-) • Real effective exchange rate (-)
Temesgen (2016)	Ethiopia	Fixed effect model	2004-2013	• Interest rates (+) • Real effective exchange rate (-) • Bank capital (-) • Credit risk (-) • Liquidity ratio (-) • Bank deposit (+)

Damane and Molapo (2017)	Lesotho	ARDL	2005-2014	• Bank deposits (+) • Net foreign assets (-)
Adeleke and Awodumi (2018)	Nigeria	ARDL	1970-2015	• Real effective exchange rate (+) • Money supply (+) • Net foreign liabilities (+) • Gross domestic product (+) • Inflation (-)
Katusiime (2018)	Uganda	OLS	1995-2017	• Inflation (+)
Hakwashika (2018)	Namibia	Cointegration and error correction techniques	2005-2017	• Gross domestic product (+)
Mallinguh and Zoltan (2018)	4 out of 6 East African economic blocks	ECM	2013-2016	• Inflation (-)
Adegbenle et al. (2020)	Nigeria	ARDL	1980-2018	• Inflation (-) • Interest rates (-) • Real effective exchange rate (+)
South Africa				
Clarke and Cull (2006)	South Africa	Two-limit Tobit model	2005	• Race (+/-) • Size of a firm (+) • Age of a firm (+)
Bbenkele (2007)	South Africa	Qualitative survey technique	2007	• Geography (+/-) • Collateral (-) • Information asymmetries (-)
Fatoki and Odeyemi (2010)	South Africa	Logistic regression	2009	• Education (+) • Geography (+/-)
Okurut (2010)	South Africa	Multinomial Logit and Heckman probit model	1995-2000	• Age (-) • Gender (+/-) • Race (+-) • Household size (+) • Education (+) • Household per capita (+)
Chimucheka and Rungani (2013)	South Africa	Triangulation research design	2013	• Lack of financial deposit (+) • Poor business plan (+) • Business idea not being viable (+) • Lack of collateral (+)
Agwa-Ejon et al. (2015)	South Africa	Probability sampling method	2015	• Lack of understanding of banking products (+/-)
Muzinduti and Nhlapho (2017)	South Africa	ARDL & Toda-Yamamoto approach of Granger causality test	1995-2015	• Country risk (-)
Akinsola and Ikhide (2019)	South Africa	VAR	2008-2014	• Business cycle (+) • Gross domestic product (+)

Note: (+) represents a positive impact, (-) represents a negative impact, and (+ /-) represents uncertain impact on private sector credit extension.

3.5 CONCLUSION

This chapter focused on what determines credit extension based on theoretical frameworks and empirical literature. For most variables, the study has found a positive link between what theory dictates and what empirical literature has found based on studies from different parts of the world. Firstly, the international empirical findings have been consistent with theoretical frameworks on most studies with very few findings opposing theoretical determinants. Theory argues that GDP is a main determinant of both credit demand and supply and is positively related to credit extension. This theoretical argument has been supported by empirical findings on all studies, which included GDP as a determinant, and found a positive relationship with credit extension. In sub-Saharan Africa, GDP was also found to be positively related to credit extension by all researchers whose work has been reviewed.

Empirical findings on interest rate are both in support of and in contradiction to theory in both international and sub-Saharan Africa, however, the variable was found to be a main determinant of credit extension. Bank deposit empirical findings were also largely found to be positively related to credit and consistent with theory in both international and sub-Saharan Africa. Similarly, empirical findings on property prices were found to be positively related with credit extension and consistent with theory. Meanwhile, real wage rate was found to be negatively related to credit and inconsistent with theory. Public sector credit and fiscal deficits were also found to be negatively related to credit and consistent with theory. Lastly, inflation and real effective exchange rate produced findings that are inconsistent with theory as some authors established a positive relationship while some found a negative relationship.

Both international and sub-Saharan Africa researchers have given enough attention to the analysis of bank credit and identified the main determinants as per the above reviews. However, in South Africa, most researchers focused on qualitative methods (surveys) and only analysed qualitative variables – such as age, race, collateral, level of education, country risk and information asymmetries – to study the determinants of credit and ignored most macro and micro economic quantitative determinants on their studies. Most researchers from all regions were not specific as to which side of credit extension they were analysing. The study strives to fill this gap by analysing the determinants from the demand and supply sides and adding to the body of knowledge from a South African perspective.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION

In this section, the method of estimation will be discussed with the aim of explaining the outcomes of the literature in an empirical manner. This section is divided into various sections and sub-sections: the researcher starts with the empirical model specification, which is based on previous research papers reviewed and found it to be suitable for the study to adopt. The second section describes the estimation techniques, and the third section describes post estimation techniques. The fourth section describes data sources, design, and analysis. It includes a sub-section that provides description and justification of variables. Lastly, the fifth section summarises and concludes the section.

4.2 THE EMPIRICAL MODEL SPECIFICATION

The study specifies an empirical model that has been successfully employed by researchers such as Imran and Nishat (2013), Assefa (2014), Damane and Molapo (2017), Muzindutsi and Nhlapho (2017), Adeleke and Awodumi (2018), Adegbenle et al. (2020) and Hamua et al. (2020).

The empirical model is specified as follows:

$$\ln PSCE\ (D)_t = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln INTR_t + \beta_3 \ln INFL_t + \beta_4 \ln REER_t + \beta_5 \ln PRP_t + \beta_6 \ln RWR_t + \beta_7 \ln PUBSC_t + \varepsilon_t$$

Equation 4.1

$$\text{In}\ PSCE\ (S)_t = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln PRP_t + \beta_3 \ln INTR_t + \beta_4 \ln BD_t + \beta_5 \ln GDEF_t + \varepsilon_t$$

Equation 4.2

Where, from the demand side (D):

$\ln$, represents natural logarithm, InPSCE is the natural logarithm of private sector credit extension, β ($\beta_0,\ \beta_1, \beta_2,\ \beta_3,\ \beta_4,\ \beta_5,\ \beta_6, \beta_7$) represents the coefficients of the model, InGDP is the natural logarithm of gross domestic product, InINTR is the natural logarithm of interest

rate, InINFL is the natural logarithm of inflation, InREER, is the natural logarithm of real effective exchange rate, InPRP is the natural logarithm of property prices, InRWR is the natural logarithm of real wage rate, InPUBSC is the natural logarithm of public sector credit, ε is the error term, and t represents the time subscript.

And, where, from the supply side (S):

$\ln$, represents natural logarithm, InPSCE is the natural logarithm of private sector credit extension, β ($\beta_0,\ \beta_1, \beta_2,\ \beta_3,\ \beta_4, \beta_5$) represents the coefficients of the model, InGDP is the natural logarithm of gross domestic product, InPRP is the natural logarithm of property prices, InINTR is the natural logarithm of interest rate, InBD is the natural logarithm of bank deposits, InGDEF is the natural logarithm of government deficit, ε is the error term, and t represents the time subscript.

The econometrics theory suggests that applying logarithms can result in well-behaved distributions as logs reduce the extrema in the data and subsequently, curtail the effects of outliers. Priestly and Subba Rao (1969) posit that logarithmic transformation can stabilise the variances of the estimates. The time series data employed in this study comprises different types such as percentages and currencies. Niyimbanira (2013) contends that it is ideal for researchers to take logarithms of variables to reflect their real growth. Our series will be transformed into logarithms to enjoy the advantages of logarithmic transformation and realign the data into the same output.

4.3 ESTIMATION TECHNIQUES

4.3.1 Stationarity tests

The study seeks to perform various tests aimed at determining the quality of the time series data contained in the model. This will be done by performing various tests referred to as unit root tests, and these tests are used to determine if the data is stationary or non-stationary. Unit root tests will be used to test for the stationarity or non-stationarity on all the variables to be regressed in the study. In describing a unit root, Gujarati (2004:744) states that “if p is in fact 1, we face what is known as the unit root problem, that is, a situation of non-

stationarity. However, when the absolute value of p is less than one, then it can be shown that the time series Yt is stationary". Engle and Granger (1987) argue that economic time series data must be differenced before they can be assumed to be stationary or for stationarity assumption to hold. On the other hand, Atiq et al. (2021) refutes the common assumption that unit root presence is the main cause of spurious regression.

Kennedy (1996) holds that time series data are known to be non-stationary by nature and may lead to a researcher concluding on the existence of a significant relationship (cointegration) between regression variables while there is none. Furthermore, Gujarati (2004) recommends the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) tests to check for stationarity with the aim of establishing if the time series contains a unit root or not. Similarly, Harris (1996) asserts that the Dickey and Fuller tests have proven to be among the most used tests of stationarity.

Moreover, Neumann and Sachs (1998) define non-stationarity as an arbitrary deviation from covariance stationarity. They further unpacked the simplifying assumption of stationarity by pointing out that non-stationary variables tend to become stationary at second differencing because the variables become constant over time. Similarly, Nkoro and Uko (2016) argued that unit roots are a major source that leads to non-stationarity and consequently, non-stationarity can lead to structural breaks within the series. The authors refute the theoretical argument that time series data is assumed to be stationary as they have observed that the bulk of the time series data are difference stationary process as opposed to being trend stationary process. Consequently, they pointed out that, although most variables become stationary after first differencing, the use of differenced time series variables for estimation purposes may lead to loss of relevant long-run properties or information that speaks or relates to equilibrium relationship of the variables under a study. Lastly, Nkoro and Uko (2016) concluded that a series with a unit root is unlikely to return to its long-run path and is likely to suffer permanent effects resulting from random shocks.

This study will first test for stationarity in all the variables included in the model. Variables that are integrated of order 2 (I (2)) will be dropped to produce reliable estimates as required by Pesaran's argument, which holds that an ARDL only yields reliable estimates when the variables are integrated of order 0 (I (0)) or order 1 (I (1)), except order 2 (I (2)).

The current study will focus on the ADF and PP tests as these are the most used tests and have been reported and acknowledged to be reliable by various researcher's analysing cointegration. In testing for the presence of unit root, the null hypothesis states that "a series has unit root". Our rejection or acceptance rule of the null hypothesis is based on the occurrence of two events: firstly, if the ADF or PP test statistic is less than the critical value at 5% level of significance, and secondly, if the probability value is less than 0.05 or 5%. We reject the null hypothesis should the critical value be more than the ADF or PP test statistic or the probability value be less 0.05 or 5% and we accept the null hypothesis should the critical value be less than the ADF or PP test statistic or the probability value be more than 0.05 or 5%.

4.3.1.1 Augmented Dickey-Fuller test

Dickey and Fuller (1979) use a statistical formula to define unit root as P+1/P<1. They argue that this formula represents non-stationarity of a series and that one of the methods of transforming economic time series data into stationarity is by way of differencing the series to an acceptable order of integration. According to Enders (2004), it is recommended to use the ADF test when the model contains negative moving average terms. The ADF test is an extension of the Dickey-Fuller test. One of its advantages is its ability to adjust the Dickey-Fuller test to take care of possible autocorrelation in the error term. The ADF does this by adding the lagged difference term of the dependent variable (Guajarati, 2004; Nkoro & Uko, 2016). The other advantage of the ADF is due to its popularity and wide application. Wide application means that the ADF can be applied to large time series data and its applicability is easy (Nkoro & Uko, 2016).

The ADF test is given by the following equation:

$$\gamma = \mathrm{C} + \beta_t + \alpha\gamma_{t-1} + \emptyset\Delta\gamma_{t-1} + \emptyset_2\Delta_{t-2} + \emptyset p\Delta\gamma_{t-p} \qquad \text{Equation 4.3}$$

Where γ_t represents value in time series at a time t or lag of 1 time series. The increment γ_t represents first difference of the series at time (t-1).

4.3.1.2 Phillips-Perron test

Phillips and Perron (1988) concede that formal statistical tests of detecting whether a series contains a unit root or not, are of paramount importance to economists as they can help in evaluating the nature of the non-stationarity that most economical time series data contain.

The PP test can be used when the model contains positive moving average terms. Enders (2004) further advises that it is wise to use both types of unit root tests because one can never be certain of the data generating process. He contends that using the PP test can restore confidence in the results if it reinforces the ADF test. The PP test is preferred by most econometricians due to its ability to account for autocorrelation in the error term and its asymptotic distribution. This implies that one does not have to add the lagged difference terms when applying the PP test. The other advantage of the PP test is based on its ability to accurately assess stationarity and non-stationarity on general forms of heteroscedasticity in the error term (Guajarati, 2004).

The Phillips-Perron test is given by the following equation:

$$\gamma t = \alpha + P\gamma t - 1 + \delta t + ut \qquad \text{Equation 4.4}$$

Where γ_t represents value in time series at a time t and delta δ represents the first difference of the time series.

Lastly, the unit root has three equations that consist of the intercept, trend, and intercept and the none formula. The study only makes use of the trend and intercept formula. The trend and intercept are given as follows:

$$\Delta Y_t = \alpha + \beta T + \delta Y_{\text{t-1}} + u_t \qquad \text{Equation 4.5}$$

4.3.2 Autogressive distributed lag (ARDL) bounds testing approach

The study seeks to empirically analyse the long-run relationships between the dependent and independent variables using the ARDL approach to cointegration as introduced and recommended by Pesaran and Shin (1997), Pesaran (1997), and as augmented by Pesaran, Shin and Smith (2001).

The ARDL approach to cointegration is preferred over conventional cointegration methods such as Granger and Engle cointegration (1987) and Johansen cointegration (1988, 1991, 1995), for several advantageous reasons. Firstly, that the ARDL can produce valid inferences on both the long-run and short run periods (Pesaran & Shin, 1997). Secondly, Pesaran and Shin (1997) have established that the ARDL does not require pretesting (pretesting is usually done to confirm the order of integration of variables in the study, before proceeding to test

for cointegration between variables). The authors cemented their view by noting that pretesting for identification of a unit root is problematic where the power of the unit root test is very low and the existence of a switch in the distribution function of the test statistics has one or more roots approaching the unit. Thirdly, the ARDL approach is advantageous in that there is no need for a researcher to detrend the series to stationarity distributed lag.

The other advantages are that endogeneity is not a problem when applying the ARDL approach as this technique is free from residual correlation, and it can distinguish between dependent and independent variables (Pesaran & Shin, 1997). The authors further noted that the ARDL technique has an added advantage of identifying the cointegrating vectors where there are multiple cointegrating vectors. Lastly, another advantage is that the ECM can be deduced from the ARDL by applying a linear transformation. This transformation integrates short run adjustments with long run equilibrium without compromising long run dynamics. Alternatively, the ARDL approach is also preferred by Nkoro and Uko (2016) because it does not omit variables or lead to spurious regression results due to differences in integration of the variables under study. Although, they have cautioned fellow researchers to avoid stochastic trends of I (2) as this may lead to the ARDL model crushing.

The study will use quarterly time series data and the PSCE model will be estimated in two separate forms: one for the demand side (D) and the other for the supply side (S). The long-run ARDL method for PSCE determinants from a demand side will be estimated as follows:

$$\ln PSCE(D)_t = \beta_0 + \sum_{\mathrm{i}=1}^{\mathrm{P}} \beta_1 \ln PSCE_{t-1} + \sum_{i=0}^{P} \beta_2 \ln GDP_{t-1} + \sum_{i=0}^{P} \beta_3 \ln INTR_{t-1} + \sum_{i=0}^{P} \beta_4 \ln INFL_{t-1} + \sum_{i=0}^{P} \beta_5 \ln REER_{t-1} + \sum_{i=0}^{P} \beta_6 PRP_{t-1} + \sum_{i=0}^{P} \beta_7 \ln RWR_{t-1} + \sum_{i=0}^{P} \beta_8 \ln \mathrm{PUBSC}_{t-1}\, \delta_1 \ln PSCE_{t-1} + \delta_2 \ln GDP_{t-1} + \delta_3 \ln INTR_{t-1} + \delta_4 \ln INFL_{t-1} + \delta_5 \ln REER_{t-1} + \delta_6 \ln PRP_{t-1} + \delta_7 \ln RWR_{t-1} + \delta_8 \ln PUBSC_{t-1} + \mathcal{E}_t \qquad \text{Equation 4.6}$$

Where β is the short run coefficient, δ is the long-run coefficient and Ɛ is the white-noise error term of the model. In addition, t denotes time period; and P is the maximum number of lags in the model.

The short run dynamics are reparametrised into an ECM version of ARDL, as follows:

$$\ln\Delta PSCE(D)_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \ln\Delta PSCE_{t-1} + \sum_{i=0}^{P} \beta_2 \ln\Delta GDP_{t-1} + \sum_{i=0}^{P} \beta_3 \ln\Delta INTR_{t-1} + \sum_{i=0}^{P} \beta_4 \ln\Delta INFL_{t-1} + \sum_{i=0}^{P} \beta_5 \ln\Delta REER_{t-1} + \sum_{i=0}^{P} \beta_6 \ln\Delta PRP_{t-1} + \sum_{i=0}^{P} \beta_7 \ln\Delta RWR_{t-1} + \sum_{i=0}^{P} \beta_8 \ln\Delta PUBSC_{t-1} + \delta ECM_{t-1} + \mathcal{E}_t \quad \text{Equation 4.7}$$

Where Δ is the first difference operator and δ is the coefficient of the error correction term, ECM_{t-1}.

The long-run ARDL method for PSCE determinants from a supply side perspective will be estimated as follows:

$$\ln PSCE(S)_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \ln PSCE_{t-1} + \sum_{i=0}^{P} \beta_2 \ln GDP_{t-1} + \sum_{i=0}^{P} \beta_3 \ln PRP_{t-1} + \sum_{i=0}^{P} \beta_4 \ln INTR_{t-1} + \sum_{i=0}^{P} \beta_5 \ln BD_{t-1} + \sum_{i=0}^{P} \beta_6 \ln GDEF_{t-1} \;\; \delta_1 \ln PSCE_{t-1} + \delta_2 \ln GDP_{t-1} + \delta_3 \ln PRP_{t-1} + \delta_4 \ln INTR_{t-1} + \delta_5 \ln BD_{t-1} + \delta_6 \ln GDEF_{t-1} + \mathcal{E}_t \quad \text{Equation 4.8}$$

Where β is the short-run coefficient, δ is the long-run coefficient and Ɛ is the white-noise error term of the model. In addition, t denotes time period; and P is the maximum number of lags in the model.

The short-run dynamics are reparametrised into an ECM version of ARDL, as follows:

$$\ln\Delta PSCE(S)_t = \beta_0 + \sum_{i=1}^{P} \Delta\beta_1 \ln PSCE_{t-1} + \sum_{i=0}^{P} \beta_2 \ln\Delta GDP_{t-1} + \sum_{i=0}^{P} \beta_3 \ln\Delta PRP_{t-1}$$

$$+\sum_{i=0}^{P}\beta_4 \ln\Delta INTR_{t-1} + \sum_{i=0}^{P}\beta_5 \ln\Delta BD_{t-1} + \sum_{i=0}^{P}\beta_6 \ln\Delta GDEF_{t-1}$$

$$+ \delta ECM_{t-1} + \mathcal{E}_t \qquad \text{Equation 4.9}$$

Where Δ is the first difference operator and δ is the coefficient of the error correction term, ECM_{t-1}.

When employing the ARDL, we have two hypotheses for each model (the demand and supply side models), namely, the null and alternative hypotheses. For the demand side model, our null hypothesis is stated as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0 \ (There\ are\ no\ long-run\ relationships)$$

The alternative hypothesis is given as follows:

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7 \neq 0 \ (There\ are\ long-run\ relationships)$$

For the supply side model, our null hypothesis is stated as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0 \ (There\ are\ no\ long-run\ relationships)$$

The alternative hypothesis is given as follows:

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0 \ (There\ are\ long-run\ relationships)$$

There are two procedures involved in applying the ARDL to test for the existence or non-existence of long-run relationships (cointegration) in the models. Firstly, cointegration is established when one or more of the long-run regressors in equations 4.6 and 4.8 are significantly different from zero. This implies that we will reject the null hypothesis, which dismisses the existence of long-run relationships. The second procedure involves testing for linear/level relationships and is based on the Wald test where the F-statistic is compared with the upper and lower critical bounds developed by Pesaran, Shin and Smith (2001). We reject the null hypothesis should the F-statistic be more than the upper or lower critical bound, and alternatively, we accept the null hypothesis should the opposite occur. In conclusion, rejection of the null hypothesis implies that there is cointegration among the variables.

The final step involves the reparameterisation of the ARDL into an ECM. The δ in equations 4.7 and 4.9 represents the coefficient of the error correction term, ECM_{t-1}, which is expected to have a negative sign. The coefficient of the error correction term measures the short run speed of adjustment, which restores disequilibrium towards the long run.

4.3.3 Lag Length Selection

The optimal lag length section for the ARDL approach will be based on the information criteria such as the Alkaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), or the Hannan-Quinn Criterion (HQC), amongst others. Nkoro and Uko (2016) cautioned that one needs to confirm the optimal lag length by employing model order selection criteria, to ensure that a suitable model is selected. When the lag lengths chosen by all information criteria mentioned above are the same, such a chosen lag length will be employed for both the demand and supply side ARDL models.

4.4 POST ESTIMATION DIAGNOSTIC TESTS

Formal and informal diagnostic tests will be performed to test for heteroscedasticity, auto correlation and multicolinearity. The Ramsey RESET test will be employed to test for model specification, while the Jarque-Bera test will be employed to test for normal distribution of the residuals. Lastly, stability tests will be performed to check if the parameters in the model have remained stable during the period of the study.

4.4.1 Heteroskedasticity

Various econometricians employ different diagnostic tests to check for the presence of heteroscedasticity in the series. Birau (2012) analysed the presence of heteroscedasticity in financial data and employed diagnostic tests such as the Breusch-Pagan test, White's test, and the Glesjer LM test, and discovered that all tests were able to produce similar results in detecting heteroscedasticity. Gujarati (2004) describes heteroscedasticity as variables that do not have equal or constant variances. The author further notes that heteroscedasticity can also be due to incorrect transformation of data such as first difference transformation. Lastly, Gujarati holds that heteroscedasticity is normally found in cross-sectional data rather than in time series data.

White (1980) argues that a properly specified linear model can produce constant, but inefficient results in the presence of heteroscedasticity in the series and consequently leads to spurious inferencing. He further contends that the presence of heteroscedasticity in the disturbances leads to faulty inferences when testing for statistical hypotheses. In addition, he argues that a formal model of process that generates differing variances can eliminate the difficulties by transforming the data. Once heteroscedasticity is detected, various remedial actions are available to the researcher, which includes the adoption of weighted least squares or differencing the time series data to an acceptable order of integration such as I (1). On the one hand, White notes that econometrics sampling requires disturbances to be homoscedastic to produce reliable and accurate estimates. On the other hand, he argues that one does not necessarily need to eliminate heteroscedasticity to draw proper and reliable estimates and inferences.

When testing for the presence of heteroscedasticity, the null hypothesis states that there is the presence of heteroscedasticity in the model. The rejection or acceptance rule is based on a comparison of the observed R-squared with the probability value at 5% level of significance. We reject the null hypothesis should the observed R-squared be more than 0.05 or 5%. Alternatively, we do not reject the null hypothesis should the observed R-squared be less than 0.05 or 5%.

4.4.2 Autocorrelation

Autocorrelation is defined as the existence of correlation between members of a series of observation ordered in time or space (Gujarati, 2004). The author holds that serial correlation can occur due to sluggishness in the series, and that one of the consequences of using OLS in the presence of autocorrelation is that the estimates will remain unbiased and consistent but will produce inefficient estimates with minimum variances. Similarly, Granger and Newbold (1974) have studied spurious regressions in econometrics and identified three consequences of autocorrelation, namely, that the estimates of the regression coefficients tend to be inefficient, the forecasts based on regression equations can be sub-optimal, and lastly, the usual significance tests on the coefficient can be invalid because of autocorrelation.

Gujarati (2004) holds that there are various methods of detecting autocorrelation, and some of the common methods include the Dubin-Watason test, the runs test, the graphical method, and the Breush-Godfrey test. Like multicolinearity and heteroscedasticity, autocorrelation

can be remedied by applying the following methods: firstly, by finding out if the autocorrelation is pure correlation and not the result of model misspecification and, secondly, by appropriate transformation, which eliminates pure autocorrelation if the autocorrelation is detected and identical. In addition, one can also use the Newey-West test to obtain standard errors of the OLS estimates that are corrected for autocorrelation, while, in certain circumstances, one can continue to employ the OLS method.

When testing for serial correlation, the null hypothesis states that the data is serially correlated. The rejection or acceptance rule is based on the comparison of the observed R-squared or probability chi-squared with 0.05 or 5% level of significance. We reject the null hypothesis should the observed R-squared or probability chi-squared be more than 0.05 or 5%. Alternatively, we accept the null hypothesis should the observed R-squared be less than 0.05 or 5% level of significance.

4.4.3 Multicolinearity

Gujarati (2004) describes multicolinearity as the existence of a perfectly linear relationship between some or all independent variables of a regression model. The author pointed out that multicolinearity may result from various sources, and is usually due to data collection methods, specification of a regression model, constraints on the model or an over determination of a regression model, or the possibility of regressors sharing a common trend. In addition, Gujarati posits that multicolinearity is one of the methodological challenges discussed by every econometrician. He, however, cautions that although this needs to be accounted for, multicolinearity still does not violate the regression estimates. Furthermore, he argues that the existence of multicolinearity will lead to unbiased consistent estimates and ultimately, standard errors will be estimated correctly. Conversely, he contends that the only challenge with the existence of multicolinearity is that it makes it difficult to obtain coefficient estimates with serial standard errors (Gujarati, 2004).

Gujarati highlighted some methods of detecting muliticolinearity, which includes detecting the degree of collinearity by high R2, high pairwise correlations or auxiliary regressions, which is to regress one variable against the other. Alternatively, he recommends that the best way to correct or avoid the problem of multicolinearity is by omitting the highly collinear variable, which will lead to other variables being statistically significant. An example of multicolinear

variables is income and wealth and, in this study, we are guided by theory and a priori when choosing variables to include in the study and simultaneously avoid multicolinearity by avoiding or dropping variables that exhibit characteristics of being collinear with other chosen variables in the study.

When testing for multicollinearity, the null hypothesis states that there is no severe multicollinearity in the model. The rejection or acceptance rule is based on determining the variance inflation factor (VIF). We reject the null hypothesis should the VIF be more than 10. Alternatively, we do not reject the null hypothesis should the VIF be less than 10.

4.4.4 Specification test

There are generally two common types of model specification, which results in errors when a researcher specifies a model. Gujarati (2004) refers to these errors, and he argues that this may be a result from under fitting the model. This relates to omitting necessary variables in the model and overfitting a model, which relates to including unnecessary variables in the model. The classical linear regression model (CLRM) makes various assumptions around stationarity and specification of econometric modelling. Regarding specification, the CLRM assumes that a model is correctly specified, failure of which may lead to model specification error or specification bias. Various tests can be conducted to confirm the specification of our ARDL model; the tests include among others, checking the R2 value, checking the t-ratios, Dubin-Watson statistic, the Lagrange multiplier, and the Ramsey RESET test. The study will focus on the Ramsey RESET test to confirm whether our model is correctly specified or not.

When testing for model specification, the null hypothesis states that the model is correctly specified. The rejection rule is based on the value of the Ramsey RESET test. We reject the null hypothesis should the F-statistic probability value be less than 0.05 or 5%. Alternatively, we accept the null hypothesis should the F-statistic probability value be more than 0.05 or 5%.

4.4.5 Normality test

Montalos (2010) holds that testing for normally distributed data should be treated as an equally important step compared to the assumption of normality. Similarly, Ghasemi and Zahediasi (2012) contend that the assumption that disturbances are normally distributed

should be taken seriously, because when the assumptions are violated or do not hold, it becomes challenging to reach accurate and reliable estimates and conclusions. There are various ways to test for normality and most of these tests are a supplement to the virtual assessment of normality (Ghasemi & Zahediasi, 2012). The tests include, among others: histogram of residuals, normal probability plot, Anderson-Darling normality test, Kolmogrov-Smirnov test, Shapiro-Wilk test, Cramer-Von Mises test, D'Agostino skewness test, Anscombe-Glynn kurtosis test, D'Agostino-Pearson omnibus test, and the well-known Jarque-Bera test (Ghasemi & Zahediasi, 2012).

The study will make use of one virtual test and one non-virtual test, namely the histogram of residuals test and the Jarque-Bera test. On the one hand, the histogram of residuals divides the values of the variables under the study into suitable intervals and superimposes a bell-shaped normal distribution curve on the histogram (Gujarati, 2004). On the other hand, the Jarque-Bera test computes the variances in skewness and kurtosis for each variable in the study. The Jarque-Bera null hypothesis states that the residuals are normally distributed and follows a chi-square distribution with two degrees of freedom (Jarque & Bera, 1980, 1987).
When testing for normality, that is if the residuals are normally distributed, the null hypothesis states that the residuals are normally distributed. The rejection or acceptance rule is based on checking the Jarque-Bera test statistic probability value. We reject the null hypothesis should the Jarque-Bera probability value be less than 0.05 or 5%. The alternative hypothesis will be accepted should the Jarque-Bera probability value be more than 0.05% or 5%.

4.4.6 Stability tests

A stability test will be performed to check if there is variance stability or instability in the model during the period of the study. This will be done through the Cumulative sum, and Cumulative sum of squares tests. When testing for model stability, the null hypothesis indicates that there is variance stability in the model. The rejection rule is based on the CUSUM or CUSUM of squares recursive residuals moving within the upper and lower critical lines at 5% level of significance. We reject the null hypothesis should the CUSUM or CUSUM of squares recursive residuals move outside both the upper and lower critical lines at 5% level of significance.

4. 5 DATA SOURCES, DESIGN, AND ANALYSIS

Time series data for the study will be collected from various reliable sources such as Easydata Quantec (2022) and the SARB (2022). The study will apply the quantitative research design method to evaluate the trends and determinants of PSCE and the selected explanatory variables in South Africa for the period 1990Q1 to 2021Q4. The study will rely on quarterly time series data for a period of 31 years (124 observations). Statistics and econometrics tests such as the unit root tests, multi-linearity and autocorrelation test will be performed to check the validity of the data. All tests are to be performed and analysed using the statistical software e-views version 12.

4.5.1 Description and justification of variables

The next section provides the description and justification of the variables to be analysed in the study. We start by providing a summary by way of tables (table 4.1 and table 4.2), which provide a view on the abbreviations, transformation, data source and expected sign on PSCE, for each variable included in the study.

Table 4.1 Determinants of private sector credit extension from the demand side

Variable	Abbreviation	Transformation	Data Source	A Priori (Expected Sign on PSCE)
Private Sector Credit Extension	PSCE	Percentage (%)	SARB	Dependent
Gross Domestic Product	GDP	R in millions	SARB	+
Interest Rate	INTR	Percentage (%)	SARB	-
Inflation	INFL	Percentage (%)	SARB	-
Real Effective Exchange Rate	REER	ZAR: USD	SARB	-/+

Property Prices	PRP	South African rand (ZAR)	SARB	+
Real Wage Rage	RWR	South African rand (ZAR)	SARB	+
Public Sector Credit	PUBSC	South African rand (ZAR)	SARB	-

Table 4.2 Determinants of private sector credit extension from the supply side

Variable	Abbreviation	Transformation	Data Source	A Priori (Expected Sign on PSCE)
Gross Domestic Product	GDP	R in millions	SARB	+
Property Prices	PRP	R in millions	SARB	+
Interest Rate	INTR	Percentage (%)	SARB	+
Bank Deposit	BD	R in millions	SARB	+
Government Deficit	GDEF	Percentage (%)	SARB	-

Table 4.1 and table 4.2 above have provided abbreviations, transformation, data sources, and the expected signs on PSCE. We proceed to provide descriptions and justification of the variables in the next sub-section.

In determining and analysing the determinants of PSCE, the study assesses GDP, interest rates, inflation, real effective exchange rate, property prices, real wage rate and public sector credit, as the demand side determinants. The study further assesses GDP, property prices, interest rates, bank deposits and government deficit, as the supply side determinants.

4.5.1.1 Private sector credit extension

PSCE is the dependent variable for the study. Abiola et al. (2015) describes PSCE as the process of channelling financial resources to the private sector. The resources include loans and advances, purchases of non-equity securities, trade credits and other receivable accounts, to establish a claim for future repayments. This macroeconomic variable has been studied by various researchers across the world. Our empirical review reveals that researchers such as Guo and Stepanyan (2011), Kalluci and Shiajku (2014), James (2015), Damane and Molapo (2017), Hakwaashika (2018) and Hamua et al. (2020), employed quarterly time series data to analyse credit extended to the domestic private sector. Meanwhile, Sogut (2008), Okoloyo (2011), Chukwuemeka et al. (2012), Imran and Nishat (2013), Ayano (2014), Assefa (2014), Muriu (2016), and Adeleke and Awodumi (2018), employed annual time series data to investigate the determinants of credit extended to the domestic private sector. Lastly, our empirical review revealed that only Katusiime (2018) employed monthly data to analyse the determinants of private sector credit.

The SARB (2021) defines PSCE as loans and advances extended to the domestic private sector by all monetary institutions, and reports this data on a monthly, quarterly, and annual basis. In line with the studies identified above, this study analyses this variable using quarterly time series, which measures the growth or deterioration of PSCE from one quarter to the next. The change in credit extended to the domestic private sector is expressed in percentages.

4.5.1.2 Gross domestic product

The OECD (2021) defines GDP as a standard measure that measures the economic added value derived from the production of goods and services of a country, for a certain period. Meanwhile, the Bank of England (2021) defines GDP as the measure of the size and economic status of a particular country over a period. The bank noted that this period usually varies between a quarter and a year. On the other hand, the World Economic Forum (2021) describes GDP as a measure of the total end value of all goods and services produced by a country over a period.

There is consensus from a theoretical point of view, that GDP is positively linked to PSCE. Hoffman (2004) and Muriu (2016) both argue that a rise in GDP leads to households and firms borrowing more to invest in new projects. On the empirical side, this variable has been used by studies such as Calza et al. (2003), Hoffman (2004), Al Daia et al. (2011), Guo and Stepanyan

(2011), Ee et al. (2012), Gounder and Sharma (2013), Imran and Nishat (2013), Crocco et al. (2014), Kalluci and Shijaku (2014), and Da Chuna et al. (2020).

4.5.1.3 Interest rates

Faure (2014) describes interest rate as the reward paid by a borrower to a lender for the use of money borrowed from a lender for a certain period, which is expressed as a percentage of the funds borrowed, over a year. The author further notes that interest rates can be defined as the price of money. The Corporate Finance Institute (2021) defines prime interest rate as the interest rate charged by commercial banks to their credit worthy borrowers. We have defined both interest rates and prime overdraft rates because the prime overdraft rate is the proxy that will be used for interest rate measurement on this study. The South Africa Reserve Bank is the institution responsible for setting benchmark interest rates in South Africa and it does this by setting the repurchase (repo) rate and the prime rate. The repurchase rate is the rate that the Reserve Bank charges private banks for borrowing rands from it. The prime (predominant) rate is the benchmark rate that commercial banks charge when lending funds to their credit worthy customers. There is a 3.50% difference between the repo and prime rate. The study will employ the prime lending rate as a proxy to measure interest rate.

Empirical literature reviewed in this study revealed ambiguous results on the relationship between interest rate and PSCE. On the one hand, our theoretical review holds that interest rate is negatively related to credit extension because it raises the cost of borrowing (Hoffman, 2004; Khangalah, 2013; Muriu, 2016). On the other hand, and from a credit supply point of view, Rashid (2011) pointed out that high interest rates lead to a decrease in credit supply. This variable has been empirically analysed by researchers such as Qayyum (2002), Calza et al. (2003), Becke, Egert and Zummer (2006), Karlan and Zinman (2007), Nieto (2007), Eller et al. (2010), Al Daia et al. (2011) and Ee et al. (2012).

4.5.1.4 Inflation

Fourie and Mohr (2008) define inflation as a continuous and considerable general increase in the prices of goods and services. Similarly, Bhattarai (2019) describes inflation as a measure of the rate at which general price levels of goods and services of a particular economy increase over a period. Inflation in South Africa is measured by STATS SA, and this is done by comparing prices of a basket of goods for the current period (month, quarter, or year) with the prices of a similar basket of goods from the previous period. Although tracked by Statistics South Africa,

the South African Reserve Bank is tasked with maintaining price stability. One of the tools they use is an inflation targeting framework where they use interest rates to control inflation with a target of a rate not lower than 3% and not more than 6%.

Theoretical literature reviewed in this study pointed to a clear relationship between inflation and PSCE. Theory holds that high inflation leads to high interest rates, which in turn leads to a decrease in credit demanded (Beck et al., 2006; Dlamini et al., 2017; Adeleke & Awodumi, 2018). Empirically, the relationship between inflation and private sector credit has been studied by researchers such as Qayyum (2002), Eller et al. (2010), Guo and Stepanyan (2011), Ee et al. (2012), Gounder and Sharma (2012), Arsene and Guy-Paulin (2013), Akinlo and Oni (2015), Adeleke and Awudomi (2018), Katusiime (2018), Malinguh and Zoltan (2018), Bhattarai (2019), and Adegbenle et al. (2020).

4.5.1.5 Real effective exchange rate

The World Bank (2021) defines real effective exchange rate as a measure of the value of one currency against the weighted average value of another country's currency. A percentage change will be used to measure this variable by considering the average of the rand compared with the currencies of South Africa's 20 trading partners, and this data will be obtained from the SARB. Theoretical arguments have opposing views on the relationship between real effective exchange rate and PSCE. Exchange rate movements affect credit demanded by exporters and importers differently and lead to an ambiguous impact. The study expects either a positive or a negative impact on credit demanded by the private sector. On the empirical side, this determinant has been studied by researchers such as Olokoyo (2011), Chikwuemeka et al. (2012), Pham (2015), Muriu (2016), Temesgen (2016), Adeleke and Awodumi (2018), Adegbenle (2020), and Hamua et al. (2020).

4.5.1.6 Property prices

Hoffman (2003) defines property prices as the price of a fixed property as determined by market conditions. Hoffman further notes that fixed property represents the collateralisable assets of a borrower (household and firms), and that changes in its price lead to changes in wealth or asset value. Belke and Keil (2017) define property price as the purchasing price of a fixed property. The author further notes that market prices for newly built property and existing property differ from one region to another. On the demand side, we will use prices of household residential houses as a proxy for property prices, while assets of finance

companies – fixed property prices – will be used as a proxy to measure property prices. Economic theory is very clear on property prices and credit extension, from both the demand and supply side. In line with theory, this variable is expected to have a positive relationship with both credit demand and credit supply. Empirical literature included in this study revealed that this variable has been successfully analysed by researchers such as Davis and Zhu (2004), Hoffman (2004) and Becke, Egert and Zummer (2006), and all found the determinant to be positively related to private sector credit.

4.5.1.7 Real wage rate

Ashenfelter (2012) describes real wage rate as the after-tax wage rate divided by the price of goods or services provided. He further argues that this represents a transparent measure of the amount of goods or services for which an hour of work compensates. Theoretical arguments provide clear direction on the relationship between real wage rate and private sector credit demand and supply. Kalluci and Shijaku (2014) established that the impact of an increase in wage rate is extended to savings of the private sector. The researchers argued that when the wage rate goes up, savings also increase and this ultimately improves bank deposits, which entices deposit-taking lending institutions to offer more credit to borrowers. Household disposable income will be used as a proxy to analyse real wage rate and PSCE. On the empirical side, this variable has not received enough attention and was only analysed by Kalluci and Shijaku (2014) from the literature reviewed in this study.

4.5.1.8 Public sector credit

The OECD (2021) defines public sector credit as all credit (including loans and advances) extended to the public sector by all monetary lending intuitions. The South African Reserve Bank measures this variable by aggregating net credit extended to the government sector by all monetary institutions. There is theoretical consensus regarding the impact of public sector credit and PSCE. In addition, the existence of crowding in and out has been defended by Sacerdoti (2005), Bonga-Bonga and Mabejane (2009), and Kamaly and Shetta (2014). On the empirical side, this determinant has been studied by researchers such as Temin and Voth (2004), Becke, Egert and Zummer (2006), Sogut (2008), Emran and Farazi (2009), Ali et al. (2011), Mbate (2013), Kamaly and Shetta (2014), James (2015), and Anyanwu et al. (2017).

4.5.1.9 Bank deposits

The International Monetary Fund (2004) argues that there are two types of bank deposits, namely, transferrable, and other deposits. The institution defines transferrable deposits as funds that are exchangeable on demand at par value without any restriction or penalty, are freely transferrable, and are usually used to make payments. Other deposits are defined as all monetary claims reflecting evidence of deposit except transferrable deposits. Theoretical literature included in this study provides clear guidance on the impact of bank deposits on private sector credit (supply side) and holds that a positive relationship exists. On the other hand, Imran, and Nishat (2013) link this variable to the income effect and argue that the result of an improvement on bank deposits is an increase in the willingness of banks to extend credit. Empirically, this variable has been studied by researchers such as Eller et al. (2010), Guo and Stepanyan (2011), Gounder and Sharma (2012), Assefa (2014), James (2015), Pham (2015), Temesgen (2016), Damane and Molapo (2017), Da Chuna et al. (2020), and Hamua et al. (2020).

4.5.1.10 Government deficit

Feldstein (2004) defines government deficit as the difference between the expenditure of the government and the total funds generated from taxation and all other income generating activities of the government. We will employ percentage change on national government deficit against total government budget, to measure this variable. Like public sector credit, theoretical arguments are also clear on the relationship between government deficit and private sector credit. In addition, the existence of crowding in and out has been established by Friedman (1978) and Aschauer (1998). The consensus is that there is a negative relationship between government deficit and PSCE. Empirical reviews included in this study revealed that this variable did not receive enough attention as it has only been analysed by Chakraborty (2006), Bousrih et al. (2007), and Mwigeka (2015).

4.6 CONCLUSION

This chapter has outlined and described the methodology to be employed. It started with model specification, then proceeded to estimation techniques, post estimation diagnostic tests, data collection, design, and analysis, and concluded with descriptions and justification of variables included in the study. The methodology to be employed compliments a similar

methodology employed by some authors who have analysed the determinants of private sector credit such as Imran and Nishat (2013) and Damane and Molapo (2017). The study adds a unique approach to the methodology by separating demand and supply side determinants and formulating a methodology for each side.

CHAPTER 5: PRESENTATION AND ANALYSIS OF RESULTS

5.1 INTRODUCTION

This chapter is a build-up of the previous chapter, which discussed the methodology to be adopted in the study. The purpose of this chapter is to provide empirical findings of the research hypothesis developed in chapter 1 of this study. The chapter has two main sections, namely the demand side results, and the supply side results. The first section discusses the demand side results and the second section discusses the supply side results. In each section, we begin with descriptive statistics that provide statistical characteristics and historical behaviour of the data. We then proceed to provide empirical findings, then post estimation diagnostic tests, and end with a conclusion of the chapter.

5.2 DEMAND SIDE RESULTS

This section presents and discusses the empirical results for the demand side of PSCE. The section begins with descriptive statistics, and proceeds to discuss unit root test results, which is a necessary sub-section aimed at confirming that all our variables are not integrated of order 2 (I (2)), but either level (I (0) or order 1 (I (1)). The section then discusses cointegration results, which are based on the bounds test. After establishing cointegration, the study proceeds to employ the ARDL model, which provides answers to the questions of the existence or non-existence of long-run and short-run relationships between the variables. The section ends with post estimation diagnostic tests, which give a view of how the model behaves following the estimation phase. Thereafter, a conclusion is made.

5.2.1 Descriptive statistics

Table 5.2.1 provides a summary of descriptive statistics for the time series date employed in the study, from 1990Q1 to 2021Q4. The purpose of descriptive statistics is to provide the statistical characteristics and historical behaviour of the time series data. The mean gives the average of the data, which is obtained from the summation of the data divided by the number of data points. The median gives the central or middle value, which we obtain by arranging the data into ascending order and checking the central value, which separates the first and second half of the data points.

PSCE averaged R4 429 034 billion from 1990Q1 to 2021Q4. The median for PSCE was R3 202 715 billion, which was less than its mean. This implies that PSCE was less than its average extension rate of R4 429 034 billion for a greater part of the sample period.

Table 5.2.1 Demand side descriptive statistics

	PSCE	GDP	INTR	INFL	REER	PRP	RWR	PUBSC
Mean	4429034	2479887	13.48	6.73	3.44	14.27	390906	12722
Median	3202715	1929856	12.38	5.85	2.73	15	303321	7047
Minimum	408492	324018	7	-1.7	0.1691	1	46161	58
Maximum	11146473	6287314	25	18.9	15.1705	20	1022551	102354
Std. Dev.	3529819	1829226	4.40	4.08	3.14	2.97	286979	16184
Skewness	1.04	0.90	0.75	0.65	0.68	-0.74	0.92	1.05
Kurtosis	2	1.95	2.07	3.37	5.38	9.64	2.03	13.25
Jarque-Bera	28.41	23.16	16.61	9.74	40.07	246.83	23.07	583.85
Probability	0.0000	0.0000	0.0742	0.1487	0.2906	0.0701	0.0000	0.0000
Sum	566916328	317425544	1726	861	441	1826	50035918	1628394
Sum Sq. Dev.	1594831388383770	428296694548391	2481	2130	1260	1127	10541724444664	33524029336
Observations	128	128	128	128	128	128	128	128

Skewness is a descriptive statistical method of measuring whether a data set is symmetric or asymmetric. The Corporate Finance Institution (2020) holds that skewness can measure asymmetry or the distortion of a symmetric distribution. The coefficient of skewness can also be employed together with the values of the mean, median and mode to determine the symmetric or asymmetric distribution of a data set. The Corporate Finance Institution (2020) holds that positively skewed data implies a skewness value of more than zero, which means that the mean is greater than the median and the mode therefore occurs at the highest frequency of the data set. Alternatively, the institution posits that negative skewness implies a skewness value of less than zero, which means that the mean is less than the median and the mode occurs at the highest frequency of the data set.

PSCE data for South Africa for the study period 1991Q1 to 2021Q4, is positively skewed. This implies that PSCE has been less than the average credit extension figure for most of the years in the study, compared to fewer years of above average credit extension rate for the study period. The maximum credit extended to the private sector during the study period is R11 146 473 (billion) and the minimum credit extended to the private sector during the study

period is R408 492 (million). Property price data for the study period is negatively skewed. This implies that the property prices have been more than the average property price for most of the years in the study and fewer years below the average property price. The maximum price of fixed property during the study period was R20 billion and the minimum price of fixed property was R1 billion.

Standard deviation measures the distance between the mean and an individual data point; this distance is commonly known as a dispersion. Ayeni (2014) posits that standard deviation measures the fluctuation of data points around their mean, and that a higher standard deviation value implies a higher dispersion, while a lower standard deviation value implies a lower dispersion. Muljadi (2020) argues that a low standard deviation value implies that the data points are closer to the mean, whereas a higher standard deviation value implies that the data points are widely spread. In this study, PSCE, GDP and real RWR have the highest standard deviations, while INTR, INFL, REER and PRP have the lowest standard deviation. The following section provides empirical results and economic analysis for the demand side.

5.2.2 Demand side empirical findings

The previous section discussed descriptive statistics for the demand side and the following section discusses the demand side empirical results. The section is divided into three sub-sections; namely, unit root tests, ARDL test results (which includes the bounds test), long-run, and short-run results. The last part of the section discusses the post estimation diagnostic tests.

5.2.2.1 Unit root tests

The unit root tests were carried out by way of two types of stationarity tests, namely, the ADF test and the PP tests. We carried out the tests using the trend and intercept formula. The *,** and*** represent 10%, 5% and 1% level of significance, respectively. This implies that the test statistics were compared with critical values at 10%, 5% and 1% levels of significance. I (0) represents stationarity at level, and I (1) represents stationarity at first difference. The null hypothesis stated that a series has a unit root. We reject that null hypothesis should the critical value be more than the ADF and PP test statistics. The researcher concludes a series to be stationary only when the ADF or PP test statistics are less than the critical values at all (1%, 5% & 10%) levels of significance.

The following table provides a summary of the unit root test results for the ADF test at level and at first difference. The purpose of the tests is to confirm that order of integration for all variables and ensure that no variable is I (2) as our regression model requires that variables be integrated of either I (0) or I (1).

Table 5.2.2 Augmented Dickey-Fuller tests' results

Variables	At Level			At First Difference			Stationarity by Order
	Test Equation	ADF t-stat	Critical Values	Test Equation	ADF t-stat	Critical Values	
PSCE	Trend and Intercept	-0.3297	-4.0325 (1%)	Trend and Intercept	-4.6275***	-4.0325 (1%)	I (1)
			-3.4459 (5%)			-3.4459 (5%)	
			-3.1479 (10%)			-3.1479 (10%)	
GDP	Trend and Intercept	-0.1132	-4.0325 (1%)	Trend and Intercept	-10.7590***	-4.0331 (1%)	I (1)
			-3.4459 (5%)			-3.4462 (5%)	
			-3.1479 (10%)			-3.1480 (10%)	
INTR	Trend and Intercept	-3.3696*	-4.0325 (1%)	Trend and Intercept			I (0)
			-3.4459 (5%)				
			-3.1479 (10%)				
INFL	Trend and Intercept	-6.0151***	-4.0350 (1%)	Trend and Intercept			I (0)
			-3.4471 (5%)				
			-3.1486 (10%)				
REER	Trend and Intercept	-9.2807***	-4.0319 (1%)	Trend and Intercept			I (0)
			-3.4456 (5%)				
			-3.1477 (10%)				
PRP	Trend and Intercept	-2.8286	-4.0331 (1%)	Trend and Intercept	-10.9577***	-4.0344 (1%)	I (1)
			-3.4462 (5%)			-3.4468 (5%)	
			-3.1480 (10%)			-3.1484 (10%)	
RWR	Trend and Intercept	0.0288	-4.0344 (1%)	Trend and Intercept	-7.9276***	-4.0344 (1%)	I (1)
			-3.4468 (5%)			-3.4468 (5%)	
			-3.1484 (10%)			-3.1484 (10%)	
PUBSC	Trend and Intercept	-12.3074***	-4.0319 (1%)	Trend and Intercept			I (0)
			-3.4456 (5%)				

			-3.1477 (10%)				

Notes: *, ** and *** indicate the 10%, 5% and 1% levels of significance respectively. I (0) represents stationarity at level, and I (1) represents stationarity at first difference.

The following table provides a summary of the unit root test results for the PP test at level and first difference. The purpose of the PP tests is to reinforce the ADF test results.

Table 5.2.3 Phillips-Perron test results

Variables	At Level			At First Difference			Stationarity by Order
	Test Equation	PP t-stat	Critical Values	Test Equation	PP t-stat	Critical Values	
PSCE	Trend and Intercept	0.1189	-4.0319 (1%) -3.4456 (5%) -3.1477(10%)	Trend and Intercept	-4.7472***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
GDP	Trend and Intercept	-0.0329	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-18.5690***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
INTR	Trend and Intercept	-2.7019	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-7.8774***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
INFL	Trend and Intercept	-5.8597***	-4.0350 (1%) -3.4471 (5%) -3.1486 (10%)	Trend and Intercept			I (0)
REER	Trend and Intercept	-9.2847***	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept			I (0)
PRP	Trend and Intercept	-2.8535	-4.0331 (1%) -3.4462 (5%) -3.1480 (10%)	Trend and Intercept	-10.9573***	-4.0344 (1%) -3.4468 (5%) -3.1484 (10%)	I (1)
RWR	Trend and Intercept	-4.0205**	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept			I (0)
PUBSC	Trend and Intercept	-12.3129***	-4.0337 (1%) -3.4456 (5%) -3.1482 (10%)	Trend and Intercept			I (0)

Notes: *, ** and *** indicate the 10%, 5% and 1% levels of significance respectively. I (0) represents stationarity at level, and I (1) represents stationarity at first difference.

The results revealed that the PP test results reinforce the ADF test results for most of the demand side variables. Both the ADF and PP tests found that INFL, REER and PUBSC are stationary at level, I (0), while PSCE, GDP, INTR and PRP were found to be stationary at first difference, I (1). RWR is stationary at first difference with the ADF test, while the PP test found RWR to be stationary at level.

The ADF test results for INTR at level revealed that the series is stationery at 10% level of significance. This led to the order of integration being maintained at level for INTR. The PP test results for RWR at level revealed that the series is stationery at 10% level of significance. A series is concluded to be stationary should the test statistic (either ADF or PP) be less than the critical values at either 1%, 5% or 10% levels of significance. The unit root test results presented in table 5.3.1 and table 5.3.2 found that no variable is stationary at second difference, I (2). This satisfies the ARDL condition that the model can only be employed when variables are integrated of either order 0 or order 1, but not order 2. The following sub-section proceeds to employ the ARDL model in view of the precondition having been satisfied.

5.2.2.2 Autoregressive distributed lag (ARDL)

The ARDL bounds testing approach has been chosen for its ability to test for both long-run and short-run relationships. The model has one prerequisite or precondition, which required us to confirm the order of integration of the variables as one can only employ the ARDL when variables are integrated of either I (0) or I (1), or a combination of the two. The precondition has been satisfied as all variables have been found to be stationary at I (0) and I (1). We have employed the AIC for model selection method. We have chosen three maximum lags for the independent variables.

Our demand side ARDL model is specified as follows:

Equation 5.1 Demand side ARDL model specification

$$\mathrm{Ln}\,PSCE\,(D)_t = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln INTR_t + \beta_3 \ln INFL_t + \beta_4 \ln REER_t + \beta_5 \ln PRP_t + \beta_6 \ln RWR_t + \beta_7 \ln PUBSC_t + \varepsilon_t$$

i. Demand side ARDL bounds test results for cointegration.

The following table provides empirical test results for cointegration, which tests for the existence or non-existence of a long run relationship. The purpose of the section is to test if our variables are cointegrated or not.

Table 5.2.4 Bounds test for cointegration

Bounds test				
Test Statistic	Value	Level of Significance	LCB	UCB
				Asymptotic: n=1000
F-statistic	4.2727***	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
	Note: LCB represents Lower Critical Bound and UCB represents Upper Critical Bound. K represents the independent variables employed in the model.			

The bounds testing approach has been employed to ascertain the existence of a long-run relationship in the model. The F-bound test F-statistic of 4.2727 is above the upper critical bound (UCB) of 3.9 at 1% level of significance. This implies that variables in the model are cointegrated.

ii. Demand side long-run results

Table 5.2.6 provides a summary of the demand side long run empirical findings. This section tests for long run relationships between PSCE and seven explanatory variables. The below table reveals that only four out of the seven explanatory variables have a long run relationship with PSCE.

Table 5.2.5 ARDL long-run test results

Variable	Coefficient	Std Error	t-Statistic	Prob
LGDP1	0.0130	0.1296	0.1005	0.9202
INTR1	0.0725	0.0530	1.3696	0.1737
LINFL	-0.0144**	0.0058	-2.4876	0.0144
LREER	0.0020	0.0029	0.7192	0.4736
LPRP1	0.0680*	0.0367	1.8525	0.0667
LRWR1	0.8495**	0.3885	2.1868	0.0309
LPUBSC	-0.0064*	0.0034	-1.8771	0.0632
C	0.0846**	0.0357	2.3701	0.0196

The long-run results reveal that INFL is negatively related to PSCE in the long-run with a p-value of 0.0144, which is less than the 5% and 10% levels of significance. In the long run, a 1% change in INFL will lead to a 0.0144 decrease in PSCE. This finding is in line with the empirical findings of Qayyum (2002), Imran and Nishat (2013), Mallinguh and Zoltan (2018), and Adegbenle et al. (2020). The finding on inflation bodes well for South Africa's monetary policy employed by the South African Bank, which is mandated (among others), with maintaining price stability through the inflation targeting policy. The SARB has a target to keep inflation in a range of 3% to 6% and uses interest rates adjustment to reach this objective. When inflation increases above the 6% target, the SARB increase interest rates to discourage spending and borrowing, and this results in a decrease in private sector credit extension.

PRP is positively related to PSCE in the long-run with a p-value of 0.0667, which is less than the 10% level of significance. A 1% increase in PRP will lead to a 0.0680 increase in PSCE. This finding is in line with empirical findings of Davis and Zhu (2004) and Backe, Egert and Zummer (2006). Similar to many other countries, fixed property in South Africa is regarded as collateral by lending institutions. When the values of fixed property held by the private sector increases or fixed property ownership increases, borrowers tend to demand more credit because their collateral values increased.

RWR is positively related to PSCE with a p-value of 0.0309, which is less than the 5% and 10% levels of significance. A 1% increase in RWR will lead to an 0.8495 increase in PSCE. This finding is in line with the empirical findings of Kalluci and Shijaku (2013). South Africa's wage rate has improved from R46 161 in Q1 of 1990 to R1 022 551 in Q4 of 2021. This increase in wage rate is in line with theoretical expectation and its impact can be seen in the corresponding increase in PSCE, which increased from R408 492 billion in 1990Q1 to R11 146 473 billion in 2021Q4.

PUBSC was found to be negatively related to PSCE with a p-value of 0.0632, which is less than the 10% level of significance. A 1% change in PUBSC will lead to a 0.0064 decrease in PSCE. This finding on PUBSC is in support of the empirical findings of Mbate (2013), Kamaly and Shetta (2014), James (2015), and Anyanwu et al. (2017). The South African government is not immune to budget deficits. Similar to many other developing economies, the country's deficit has been increasing continuously and this is simply due to expenditure exceeding revenue collected. The government deficit has increased from 0.10% in Q1 of 1990 to 17.20% in Q4 of 2021. One of the consequences of this is that the government must borrow from both local and international lenders to meet its expenditure needs. When the government or public sector demands more credit from local lenders, the credit available to be extended to the private sector decreases due to the crowding out effect. Lastly, the study found that GDP, INTR and REER have been found to be statistically insignificant.

iii. Demand side short-run results

Table 5.2.6 provides a summary of the short run empirical results for the demand side of PSCE. This section tests for short run relationships between PSCE and seven explanatory variables. The below table revealed that only four out of the seven explanatory variables have a short run relationship with PSCE. The other three variables were found to be statistically insignificant.

Table 5.2.6 ARDL short-run test results

Variables	coefficient	Standard error	T -statistic	Probability
LPSCE1 (-1)	0.7170***	0.0588	12.1985	0.0000
LGDP1	0.0037	0.0367	0.1005	0.9202
LINTR1	0.0205	0.0155	1.3225	0.1888
LINFL	-0.0041***	0.0014	-2.9466	0.0039
LREER	0.0006	0.0008	0.7321	0.4657
LPRP1	0.0031	0.0037	-0.8488	0.3979

LPRP1 (-1)	-0.0085	0.0038	-0.0221	0.9824
LPRP1 (-2)	0.0142***	0.0040	3.5426	0.0006
LPRP1 (-3)	0.0083**	0.0040	2.0600	0.0418
LRWR1	0.0280	0.0280	0.9997	0.3197
LRWR1 (-1)	0.0961***	0.0275	3.4937	0.0007
LRWR1 (-2)	0.0544**	0.0267	2.0337	0.0445
LRWR1 (-3)	0.0619**	0.0257	2.4069	0.0178
LPUBSC	-0.0009	0.0007	-1.2819	0.2026
LPUBSC (-1)	0.0005	0.0007	0.6743	0.5016
LPUBSC (-2)	-0.0014**	0.0007	-1.9979	0.0483
C	0.0239**	0.0113	2.1163	0.0366
ECM	-0.2829***	0.0440	-6.4288	0.0000
R-squared	0.7558	Mean dependent var	0.0259	
Adjusted R-squared	0.7193	S.D. dependent var	0.0166	
S.E. of regression	0.0088	Akaike info criterion	-6.5079	
Sum squared residual	0.0082	Schwarz criterion	-6.1212	
Log likelihood	420.4891	Hannan-Quinn criterion	-6.3508	
F-statistic	20.6959	Durbin-Watson stat	2.1915	
Prob (F-statistic)	0.0000			

Note: *, ** and *** denote level of significance at 10%, 5% and 1% respectively. The results are obtained using e-views software version 12

INFL is negatively related to PSCE in the short-run, and statistically significant with a p-value of 0.0039 at 1% level of significance. In the short-run, a 1% increase in INFL will lead to a 0.0041 decrease in PSCE. This finding is in support of the empirical findings of Eller et al. (2010), Gounder and Sharma (2012), Pham (2015), Adeleke and Awodumi (2018), and Da Chuna et al. (2020).

PRP has two lags and was found to be positively related to PSCE with a p-value of 0.0006, which is less than 1% level of significance. PRP (-2) means that a 1% drop in PRP two quarters (six months) ago, will increase PSCE by 0.0142 in the current period. PRP (-3) means that a drop of 1% in PRP three quarters (nine months) ago, will increase PSCE by 0.0083 in the current period. It was noted that PP (-2) has a bigger impact on PSCE than PRP (-3). These findings are unique because the relationship is established in lag 2 and lag 3. Although, like the findings of Hoffman (2004) who also found a positive relationship, our study reveals a positive relationship only exist with lags, whereas Hoffman (2004) found a positive relationship without lags even though he also employed quarterly time series data.

RWR has three lags and was found to be positively related to PSCE in the long run. RWR (-1) means that a 1% increase in RWR one quarter (three months) ago, will increase PSCE by 0.0961 now. RWR (-2) means that an increase of 1% in RWR two quarters (six months) ago, will increase PSCE by 0.0544 now. RWR (-3) means that an increase of 1% in RWR three quarters (nine months) ago, will increase PSCE by 0.0619 now. The biggest impact is seen in lag 1 and lag 3, however, lag 2 also has a considerable impact as RWR increases by 0.0544 due to a 1% drop that took place six months ago. The findings are in line with the empirical findings of Kalluci and Shijaku (2013), who employed VECM with quarterly time series data and found a positive relationship without lags. Our findings are unique in that the positive relationship between RWR and PSCE is established in lag 1, lag 2 and lag 3.

PUBSC has two lags and was found to be negatively related to PSCE. With two lags, PUBSC was found to be negatively related to PSCE with a p-value of 0.0483, which is less than 5% level of significance. PUBSC (-2) means that an increase of 1% in PUBSC two quarters (six

months) ago, will decrease PSCE by 0.0014 now. Researchers such as Backe, Egert and Zummer (2006), Sogut (2008), Emran and Farazi (2009), and Ali et al. (2011) also found a negative relationship between PUBSC and PSCE. However, their studies did not include lags and our study only establishes a negative relationship in lag 2. This implies that the impact of PUBSC on PSCE is only seen after two quarters. GDP, INTR and REER have been found to be statistically insignificant. Lastly, the ECM of -0.2829 implies that equilibrium will be restored at a speed of adjustment of 0.2829 in the long run.

There are similarities on the long run and short run empirical findings. Both the long-run and short-run results found that only INFL, PP, RWR and PUBSC have an impact on PSCE, while the long-run and short-run results established that GDP, INTR and REER are statistically insignificant. On both the long-run and short-run results, INFL and PUBSC have a negative relationship with PSCE, while PRP and RWR have a positive relationship on both long and short-run results.

5.2.2.3 Diagnostic tests

This section presents and discusses the post estimation diagnostic tests that are conducted to confirm whether heteroscedasticity, serial correlation, and multicollinearity are present in the data. In addition, the model also tests for model specification, normality, and stability. All these post estimation tests are performed to confirm the behaviour of the model following the estimation done in the previous section.

i. Goodness of fit

The R-squared of 74% implies that the model is of a good fit. This means that the model is robust and will not crash during the period of the study.

ii. Heteroscedasticity tests

Table 5.2.7 Tests for heteroscedasticity

Tests	Null Hypothesis (H_0)	P-value	Conclusion
Breusch-Pagan-Godfrey	There is heteroscedasticity	0.2806	Reject (H_0)

Harvey	There is heteroscedasticity	0.4374	Reject (H_0)
Glejser	There is heteroscedasticity	0.4905	Reject (H_0)
ARCH LM	There is heteroscedasticity	0.0864	Reject (H_0)

Heteroscedasticity can be tested for, using various tests. We have chosen four of the five common tests to check for the presence of heteroscedasticity in the data. The tests are the Breusch-Pagan-Godfrey, the Harvey, the Glejser and the ARCH LM test. The null hypothesis states that there is heteroscedasticity in the date. We reject the null hypothesis, should the observed R-squared p-value be more than the 0.05 or 5%. All four test results revealed that the data is homoscedastic, implying that the null hypothesis is rejected for all four types of heteroscedasticity tests.

iii. Autocorrelation test

Table 5.2.8 Test for autocorrelation

Tests	*Null Hypothesis (H_0)*	*P-value*	*Conclusion*
Breusch-Godfrey LM Test	There is serial correlation/the data is serially correlated	0.0645	Reject (H_0)

The CLRM assumes that the error terms should be independently distributed, that is, there is no autocorrelation (Gujarati, 2004). There are various methods of testing for autocorrelation. The tests include, among others, the Dubin-Watason test, the runs test, the graphical method, and the Breush-Godfrey LM test. The study has chosen to employ the Breush-Godfrey LM test and the null hypothesis states that the series is serially correlated. We compare the observed R-squared or probability chi-squared with 0.05 or 5% level of significance. We reject the null hypothesis based on the p-value of 0.0645, implying that the data is not serially correlated.

iv. Multicolinearity test

Table 5.2.9 Test for multicolinearity

Variables	Centered VIF	Null Hypothesis (H_0)	Conclusion
PSCE	1.5167	No severe multicolinearity	Do not reject (H_0)
GDP	1.3500	No severe multicolinearity	Do not reject (H_0)
INTR	1.6222	No severe multicolinearity	Do not reject (H_0)
INFL	1.4571	No severe multicolinearity	Do not reject (H_0)
REER	1.1927	No severe multicolinearity	Do not reject (H_0)
PRP	1.3072	No severe multicolinearity	Do not reject (H_0)
RWR	4.8715	No severe multicolinearity	Do not reject (H_0)
PUBSC	1.3823	No severe multicolinearity	Do not reject (H_0)

Testing for multicollinearity can be challenging as there are not many methods of testing for the presence of multicollinearity. Checking the value of Centered VIF is the common way of testing for multicolinearity. The null hypothesis states that there is no severe multicollinearity in the model. The rejection rule is based on checking the value of the VIF. The null hypothesis is therefore rejected should the value of the centered VIF be more than 10. The centered VIF values in table 5.3.8 above lead to a conclusion that there is no severe multicollinearity in the model and ultimately leads to the null hypothesis not being rejected.

v. Model specification test

Table 5.2.10 Test for model specification

Test	*Null Hypothesis (H_0)*	*P-value*	*Conclusion*
Ramsey RESET	Model is correctly specified	0.2371	Do not reject (H_0)

The CLRM assumes that a model is correctly specified, and failure of which may lead to model specification error or specification bias. Like the above diagnostic tests, model specification also has various ways of testing for model specification. The methods include checking the R2 value, checking the t-ratios, Dubin-Watson statistic, the Lagrange multiplier, and the Ramsey

RESET test. The study has elected the Ramsey RESET test and the null hypothesis states that the model is correctly specified. The Ramsey RESET p-value of 0.2371 compels us to not reject the null hypothesis and therefore implies that the model is correctly specified.

vi. Normality test

Figure 5.2.1 Test for normality (histogram of residuals)

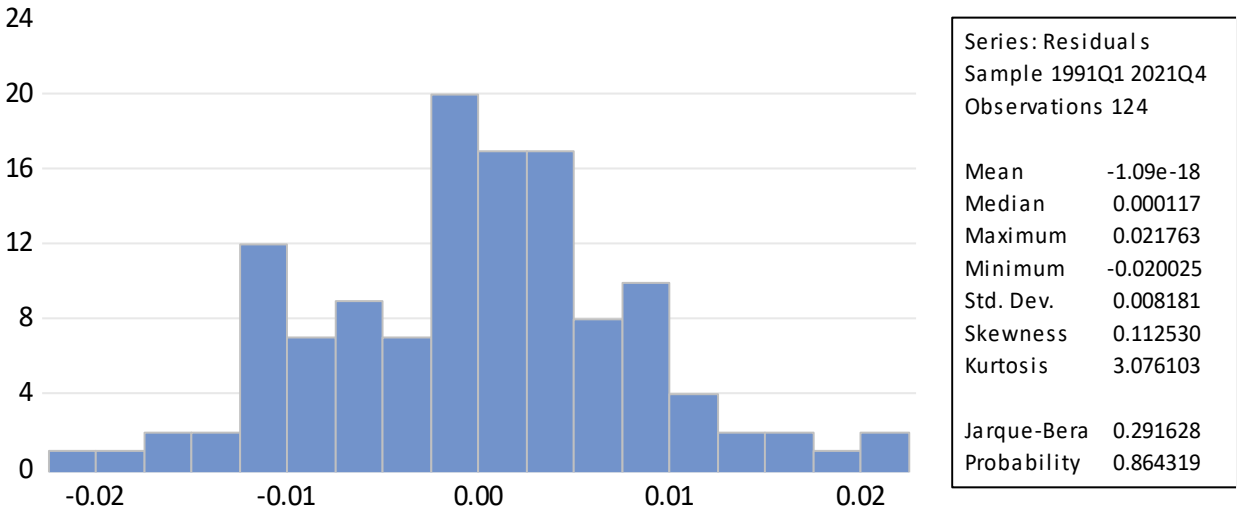


Table 5.2.11 Test for normality

Test	*Null Hypothesis (H_0)*	*Jarque-Bera P-value*	*Conclusion*
Jarque-Bera	Residuals are normally distributed	0.8643	Do not reject (H_0)

The study has adopted two methods of testing for normality, namely the virtual and econometric/non-virtual test – commonly known as the histogram of residuals and the Jarque-Bera test. The null hypothesis states that the residuals are normally distributed. We start with the histogram of residuals where the researcher mentally superimposes the bell-shaped normal distribution curve on the histogram in figure 5.2.1. Secondly, we check the Jarque-Bera test statistical probability value of 0.864319, which implies that the residuals are normally distributed.

vii. Stability Tests

Figure 5.2.2 CUSUM test

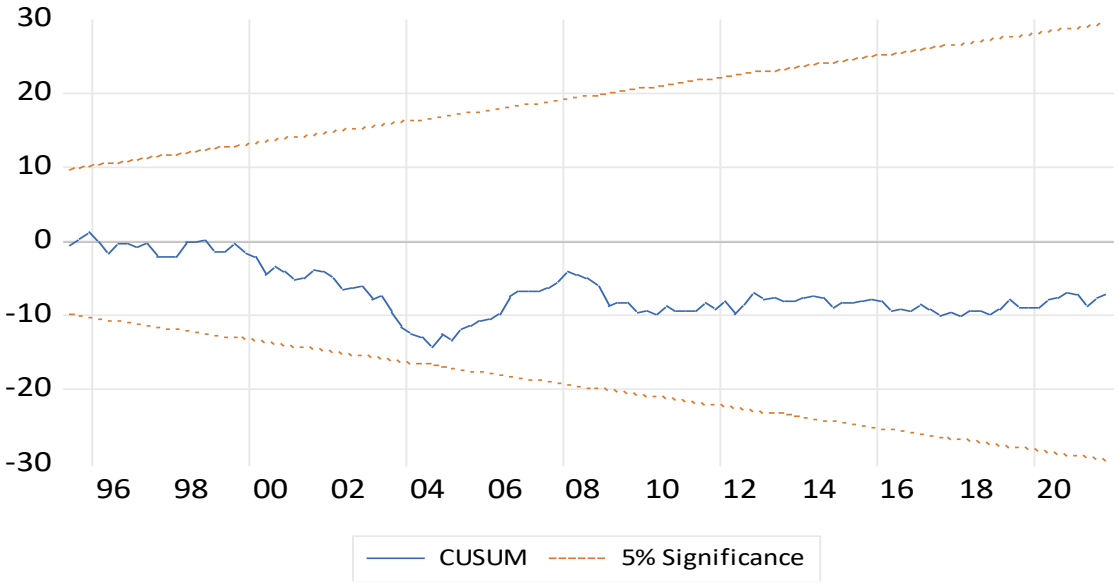


Figure 5.2.3 CUSUM of squares test

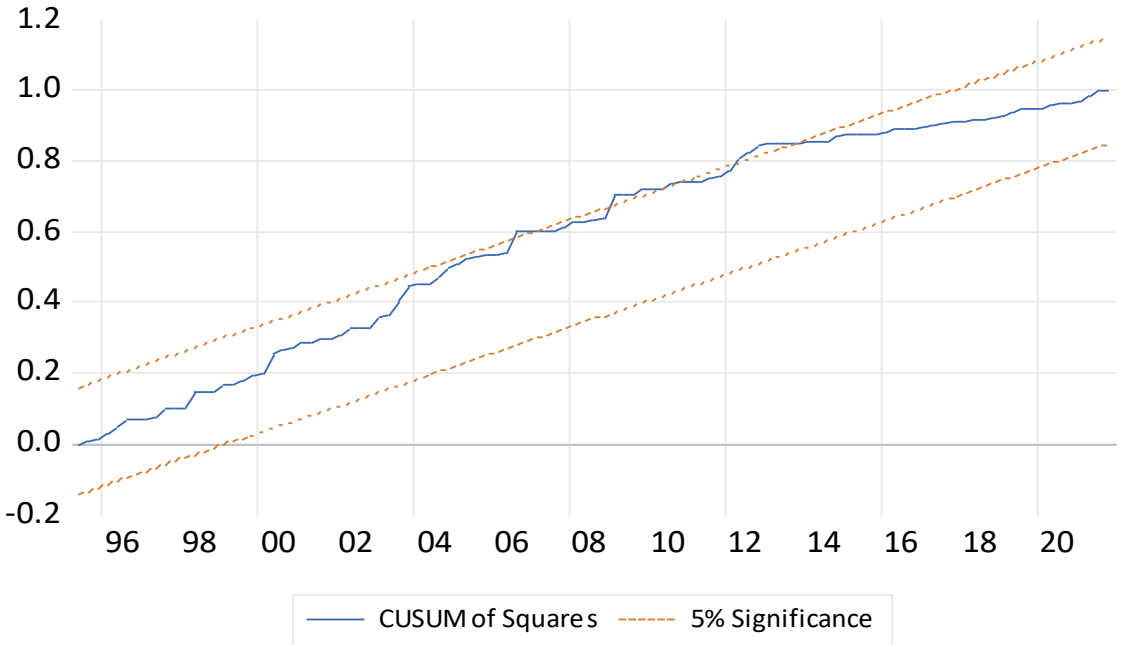


Figure 5.2.2 depicts the CUSUM stability test. The null hypothesis states that there is variance stability in the model. We do not reject the null hypothesis based on the CUSUM recursive residuals moving within the upper and lower critical lines at 5% level of significance as reflected in figure 5.2.2. Figure 5.2.3 depicts the CUSUM of squares stability test, which reflects relative variance stability from 1990 to 2005. However, the diagram reflects variance

instability from 2006 to 2007, from 2009 to 2010 and from 2012 to 2013. The variance stability is restored from 2014 to the end of 2021.

5.2.2.4 Sensitivity Analysis

The previous section suggested that there may be potential structural breaks in the series as reflected in the CUSUM of squares stability test, which reflected variance instability from 2006 to 2007, from 2008 to 2010, and from 2012 to 2013. This section investigates whether the results will be different if we account for structural breaks in our model. The global economy was faced with a financial crisis between 2007 and 2009, which is known as the Global Financial Crisis. During the same period, South Africa had to navigate through the aftermath of the crisis while adopting the National Credit Act of 2005, which became effective in 2006 and the Companies Act of 2008. These external and internal events may generate shocks and lead to structural changes in macroeconomic variables in our model. There are various ways to test for structural breaks in a series. The methods include the multiple breakpoint unit root test, the Chow test, the Perron test, and the Zivot-Andrews test, among others. This study employs the Zivot-Andrews and Perron unit root test, and the results are provided in table 5.2.12.

The Zivot-Andrews and Perron unit root test results reveal that INFL, REER and PUBSC are stationary at level, while PSCE, GDP, INTR, PRP and RWR are stationary at first difference. Having established that the demand side variables are stationary at level and first difference, we proceed to estimate the following equation:

$$\Delta \ln PSCE(D)_t = \beta_0 + \beta_1 DUM_t + \sum_{i=1}^{P} \beta_2 \Delta \ln PSCE_{t-1} + \sum_{i=0}^{P} \beta_3 \Delta \ln GDP_{t-1} + \sum_{i=0}^{P} \beta_4 \Delta \ln INTR_{t-1} + \sum_{i=0}^{P} \beta_5 \Delta \ln INFL_{t-1} + \sum_{i=0}^{P} \beta_6 \Delta \ln REER_{t-1} + \sum_{i=0}^{P} \beta_7 \Delta PP_{t-1} + \sum_{i=0}^{P} \beta_8 \Delta \ln RWR_{t-1} + \sum_{i=0}^{P} \beta_9 \Delta \ln \mathrm{PUBSC}_{t-1} + \delta_1 \ln PSCE_{t-1} + \delta_2 \ln GDP_{t-1} + \delta_3 \ln INTR_{t-1} + \delta_4 \ln INFL_{t-1} + \delta_5 \ln REER_{t-1} + \delta_6 \ln PP_{t-1} + \delta_7 \ln RWR_{t-1} + \delta_8 \ln PUBSC_{t-1} + \mathcal{E}_t \quad \text{Equation 5.2}$$

Table 5.2.12 Unit root tests with structural breaks

Stationarity of all variables at level				Stationarity of all variables at first difference		
Variable	Trend and Intercept	Lag	Break date	Trend and Intercept	Lag	Break date
Zivot-Andrews test						
ln$PSCE$	-4.6127	1	2005Q4	-4.9899*	1	2008Q2
lnGDP	-3.1117	4	2007Q1	-8.4998***	3	2008Q4
lnINTR	-4.0570	1	1998Q4	-8.4536***	0	1998Q4
lnINFL	-5.1254**	4	2006Q3	na	na	na
lnREER	-10.2115***	0	2004Q3	na	na	na
lnPRP	-4.3507	3	2005Q2	-8.2168***	2	2004Q1
lnRWR	-2.8104	4	2010Q3	-8.2398***	3	2004Q1
ln$PUBSC$	-12.8287***	0	2013Q2	na	na	na
Perron test						
ln$PSCE$	-4.5937	1	2005Q3	-6.0458**	0	2008Q1
lnGDP	-3.0962	4	2006Q4	-11.0152***	1	1999Q2
lnINTR	-4.6408	1	1998Q3	-8.9855***	0	1998Q3
lnINFL	-8.1935***	0	2004Q3	na	na	na
lnREER	-10.2087***	0	2004Q4	na	na	na
lnPRP	-5.6561**	3	2004Q4	na	na	na
lnRWR	-2.9929	4	2010Q4	-12.7063***	1	2009Q1
ln$PUBSC$	-12.8051***	0	2013Q1	na	na	na
Notes *, ** & *** indicate the 10%, 5% & 1% level of significance respectively. I(0) represents stationarity at level and I(1) represents stationarity at first difference.						

Table 5.2.13 Bounds testing with structural breaks

Bounds test				
Test Statistic	Value	Level of Significance	LCB	UCB
				Asymptotic: n=1000
F-statistic	3.4999	10%	1.85	2.85
k	8	5%	2.11	3.15
		2.5%	2.33	3.42
		1%	2.62	3.47
	Note: LCB represents Lower Critical Bound and UCB represents Upper Critical Bound. K represents the independent variables employed in the model.			

Table 5.2.14 long run results with structural breaks

Variable	Coefficient	Std Error	t-Statistic	Prob
DUM	-0.0467	0.0381	-1.2264	0.2230
LGDP1	0.5382	0.4950	1.0873	0.2796
INTR1	0.0636	0.0496	1.2823	0.2027
LINFL	-0.0162***	0.0057	-2.8531	0.0053
LREER	0.0018	0.0029	0.6317	0.5290
LPRP1	0.0514	0.0367	1.4011	0.1643
LRWR1	0.8216*	0.4912	1.6727	0.0976
LPUBSC	-0.0024	0.0023	-1.0814	0.2821
C	0.0419*	0.0249	1.6802	0.0961

Table 5.2.15 short run results with structural breaks

Variables	coefficient	Standard error	T -statistic	Probability
LPSCE1 (-1)	0.7122***	0.0622	11.4479	0.0000
DUM	0.0145*	0.0079	1.8284	0.0705

DUM (-1)	-0.0159*	0.0095	-1.6765	0.0968
DUM (-2)	0.0091	0.0098	0.9260	0.3567
DUM (-3)	-0.0211***	0.0077	-2.7359	0.0074
LGDP1	0.0143	0.0436	0.3286	0.7432
LGDP1(-1)	0.0055	0.0447	0.1231	0.9023
LGDP1(-2)	0.0116	0.0449	0.2581	0.7969
LGDP1(-3)	0.0318	0.0430	0.7402	0.4609
LGDP1(-4)	0.0917**	0.0349	2.6245	0.0101
LINTR1	0.0183	0.0144	1.2707	0.2068
LINFL	-0.0047***	0.0014	-3.4095	0.0009
LREER	0.0005	0.0008	0.6462	0.5197
LPRP1	-0.0024	0.0036	-0.6718	0.5033
LPRP1 (-1)	0.0030	0.0037	0.7788	0.4380
LPRP1 (-2)	0.0142***	0.0038	3.6909	0.0004
LPRP1 (-3)	0.0075**	0.0040	1.8820	0.0628
LPRP1(-4)	-0.0074**	0.0036	-2.0428	0.0437
LRWR1	0.0255	0.0323	0.7888	0.4321
LRWR1 (-1)	0.0932***	0.0343	2.7136	0.0079
LRWR1 (-2)	0.05790*	0.0335	1.7265	0.0874
LRWR1 (-3)	0.0560*	0.0318	1.8848	0.0624
LPUBSC	-0.0007	0.0007	-1.0376	0.3020
C	0.0121	0.0076	1.5797	0.1174

ECM	-0.2492***	0.0473	-5.2680	0.0000
R-squared	0.7906	Mean dependent variable		0.0257
Adjusted R-squared	0.7420	S.D. dependent variable		0.0164
S.E. of regression	0.0083	Akaike info criterion		-6.5623
Sum squared residual	0.0069	Schwarz criterion		-6.0136
Log likelihood	427.5806	Hannan-Quinn criterion		-6.3394
F-statistic	16.2522	Durbin-Watson stat		2.3081
Prob (F-statistic)	0.0000			

Note: *, ** and *** denote level of significance at 10%, 5% and 1% respectively. The results are obtained using e-views software version 12

Table 5.2.16 Summary of post diagnostic results with structural breaks

Test	T-statistics	P-value
Heteroscedasticity	13.1512	0.9486
Serial correlation	20.5743	0.0570
Normality	3.2788	0.1941
Model Specification	1.0893	0.2787

Equation 5.2 is similar to equation 5.1, except that a dummy variable (DUM) is included in equation 5.2. The purpose of the dummy variable inclusion is to capture the presence of multiple structural breaks in the model. DUM takes the value of zero (0) when there is no break and the value of one (1) when there is a break. The Perron unit root test detected a break in PSCE in 2008Q1, while the Zivot-Andrews unit root test detected a break in PSCE in 2008Q2. This implies that DUM will take the value of one in 2008Q1 and 2008Q2, and the value of zero for the other years.

The results of the ARDL bounds test for cointegration reveal that the calculated F-statistic is 3.4999, which is higher than the critical values reported in table 5.2.13 at 1% level of significance. This implies that the variables in the model are cointegrated. We proceed to estimate the model by choosing optimal lag length based on AIC. The selected model is ARDL (1, 3, 4, 0, 0, 0, 4, 3, 0). Table 5.2.13 and table 5.2.14 report the long run and short run results of the ARDL model with structural breaks.

Similar to the main results, the long run regression results with structural breaks accounted for by a dummy variable, reveal that only RWR is positively related to PSCE, while INFL was found to be negatively related to PSCE. The main difference between the main results and results with structural breaks is that PRP and PUBSC have been found to be insignificant on the results with structural breaks, while the same variables were found to be significant on the main results in the long run. In addition, GDP was found to be significant and positively related to PSCE in the short run on the results with structural breaks, while it was found to be insignificant on the main results. Nevertheless, the signs of the coefficient remain the same for both results in the long and short run.

The selected ARDL model fits well as supported by the R-squared value of 79.06%. The estimates are reliable as the model is free from heteroscedasticity, serial correlation, and model misspecification. In addition, the CUSUM and CUSUM of squares pass the stability tests. Based on the above findings, it is evident that the main results are reliable compared to the results with structural breaks. Lastly, the structural breaks detected in 2008Q1 and 2008Q2 can be ascribed to the 2008 Global Financial Crisis. These breaks did not have permanent effects as our model regains stability from the breakpoints to 2021Q4.

5.3 SUPPLY SIDE RESULTS

This purpose of this section is to present and discuss the empirical results for the supply side of PSCE. The section begins with descriptive statistics, and proceeds to discuss unit root test results, which is a necessary sub-section aimed at confirming that all our variables are not integrated of order 2, I (2), but either level, I (0) or order 1, I (1). The section then discusses cointegration results, which are based on the bound test. After establishing cointegration, the study proceeds to employ the ARDL model, which provides answers to the questions of the existence or non-existence of long run and short run relationships between the variables. The

section ends with post estimation diagnostic tests, which give a view of how the model behaves following the estimation phase and a conclusion is made.

5.3.1 Supply side descriptive statistics

Table 5.3.1 provides a summary of descriptive statistics for the time series date employed in the study, from 1990Q1 to 2021Q4. The purpose of descriptive statistics is to provide the statistical characteristics and historical behaviour of the time series data. PSCE averaged R4 429 034 (billion) from 1990Q1 to 2021Q4. The median for PSCE was R3 202 715 (billion), which was less than its mean. This implies that PSCE was less than its average extension rate of R4 429 034 (billion) for most observations in the sample period.

Table 5.3.1 Descriptive statistics

	PSCE	GDP	PRP	INTR	BD	GDEF
Mean	4429034	2479887	2799.26	13.48	5989037.94	3.68
Median	3202714.5	1929856.25	1646.5	12.38	4167238	3.15
Minimum	408492	324018	2	7	554212	0.1
Maximum	11146473	6287314	9619	25	16814994	17.2
Std. Dev.	3529819	1829226	3094.45	4.40	4990035.95	2.80
Skewness	1.04	0.90	1.12	0.75	1.10	0.57
Kurtosis	2	1.95	2.66	2.07	2.05	6.31
Jarque-Bera	28.41	23.16	27.38	16.61	30.63	65.36
Probability	0.0000	0.0000	0.0004	0.0742	0.0000	0.2719
Sum	566916328	317425544	358305	1725.5	766596856	470.7
Sum Sq. Dev.	1594831388383770	4282966945483 91	1225681630	2481	3187258729742540	1002
Observations	128	128	128	128	128	128

The data for PSCE, GDP and INTR is the same as that employed in section 5.2.1 (demand side descriptive statistics), and to avoid repetition, the researcher only discusses descriptive statistics for property prices, BD and GDEF. In this section, we will only discuss skewness and standard deviation in relation to PRP, BD and GDEF because the other variables were discussed in section 5.2.1. In addition, section 5.2.1 also discussed what standard deviation and skewness measure. Property Prices data for the supply side is different from the data employed on the demand side. On the supply side, PRP is positively skewed, while on the demand side, PRP is negatively skewed. Positively skewed property price data implies that property prices have been less than the average PRP for most of the years in the study and

fewer years above the average PRP. The maximum PRP during the study period was R9.619 billion and the minimum PRP was R2.799 billion.

PSCE, GDP and BD have the highest standard deviations, while PRP, INTR and GDEF have the lowest standard deviations. The following section discusses empirical results and economic analysis for the supply side.

5.3.2 Supply side empirical findings

5.3.2.1 Unit root tests

Table 5.3.2 provides a summary of the unit root test results for the ADF test at level and first difference. The purpose of the unit root test is to confirm that none of our variables are integrated of order 2, but either order 0 or order 1 because the ARDL model can only be employed with variables integrated of order 0 or 1.

Table 5.3.2 Augmented-Dickey Fuller test results

Variables	At Level			At First Difference			Stationarity by Order
	Test Equation	ADF t-stat	Critical Values	Test Equation	ADF t-stat	Critical Values	
PSCE	Trend and Intercept	-0.3297	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	Trend and Intercept	-4.6275***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
GDP	Trend and Intercept	-0.1132	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	Trend and Intercept	-10.7590***	-4.0331 (1%) -3.4462 (5%) -3.1480 (10%)	I (1)
PRP	Trend and Intercept	-3.3889*	-4.0350 (1%) -3.4471 (5%) -3.1486 (10%)	Trend and Intercept			I (0)
INTR	Trend and Intercept	-3.3696*	-4.0325 (1%) -3.4459 (5%) -3.1479(10%)	Trend and Intercept			I (0)
BD	Trend and Intercept	-0.1166	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	Trend and Intercept	-6.4525***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
GDEF	Trend and Intercept	-3.0056	-4.0337 (1%) -3.4465 (5%) -3.1482 (10%)	Trend and Intercept	-15.3882***	-4.0337 (1%) -3.4465 (5%) -3.1482 (10%)	I (1)

Notes: *, ** and *** indicate the 10%, 5% and 1% level of significance respectively. I (0) represents stationarity at level and I (1) represents stationarity at first difference.

The following table provides a summary of the unit root test results for the Phillip-Perron test at level and first difference. The purpose of the PP tests is to reinforce the ADF tests and confirm that our variables remain stationary with different unit root tests.

Table 5.3.3 Phillips-Perron test results

Variables	At Level			At First Difference			Stationarity by Order
	Test Equation	PP t-stat	Critical Values	Test Equation	PP t-stat	Critical Values	
PSCE	Trend and Intercept	0.1189	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-4.7472***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
GDP	Trend and Intercept	-0.0329	-4.0319 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-18.5690***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
PRP	Trend and Intercept	-2,7883	-4,03190 (1%) -3,4459 (5%) -3,1477 (10%)	Trend and Intercept	-15,6517***	-4,0325 (1%) -3,4459 (5%) -3,1479 (10%)	I (1)
INTR	Trend and Intercept	-2.7019	-4.03190 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-7.8774***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
BD	Trend and Intercept	-0.1413	-4.03190 (1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept	-6.8243***	-4.0325 (1%) -3.4459 (5%) -3.1479 (10%)	I (1)
GDEF	Trend and Intercept	-10.4704***	-4.0319(1%) -3.4456 (5%) -3.1477 (10%)	Trend and Intercept			I (0)

Notes: *, ** and *** indicate the 10%, 5% and 1% level of significance respectively. I (0) represents stationarity at level and I (1) represents stationarity at first difference.

The unit root tests were carried out by way of two types of stationarity tests, namely, the ADF and the PP. The results revealed that the PP test results reinforce (to some degree) the ADF test results for some of the supply side variables except for PRP, INTR and GDEF. The ADF tests found that PSCE, GDP, BD and GDEF are stationary at first difference, while PRP and INTR were found to be stationary at level. The PP tests found that PSCE, GDP, PRP, INTR and BD are stationary at first difference (I (1)), while GDEF was found to be stationary at level (I (0)).

5.3.2.2 Autoregressive distributed lag (ARDL)

The ARDL bounds testing approach has been chosen for its ability to test for both long-run and short run relationships. The model had one prerequisite or precondition, which required us to confirm the order of integration of the variables, as one can only employ the ARDL when variables are integrated of either I (0), I (1), or a combination of the two. The precondition has been satisfied as all variables have been found to be stationary at either level (I (0)) or I (1)) for both ADF and PP tests, and none of the variables were found to be stationary at second difference (I (2)). We have employed the AIC for model selection method. We have chosen three maximum lags for the independent variables.

Our supply side ARDL model is specified as follows:

Equation 5.3 Supply side model specification

$$\text{Ln}\, PSCE\ (S)_t = \beta_0 + \beta_1 \ln GDP_t + \beta_2 \ln PRP_t + \beta_3 \ln INTR_t + \beta_4 \ln BD_t + \beta_5 \ln GDEF_t + \varepsilon_t$$

i. Supply side ARDL bounds test results for cointegration.

Table 5.3.4 provides empirical test results through the bounds test, which tests for cointegration (the existence or non-existence of a long run relationship). The purpose of the bounds test is to confirm whether the variables included in the model are cointegrated.

Table 5.3.4 Bounds test results

F-Bounds Test				
Test Statistic	Value	Significance	LCB	UCB
				Asymptotic: n=1000
F-Statistic	9.1818***	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
	Note: LCB represents Lower Critical Bound and UCB represents Upper Critical Bound. K represents the independent variables employed in the model.			

The bounds testing approach for the analysis of the existence or non-existence of a long-run relationship has been employed, and it revealed that there is an existence of a long-run relationship in the model. The F-bound test F-statistic of 9.1818 is above the upper critical bound (UCB) of 4.15 at 1% level of significance. This implies that the variables included in the model are cointegrated.

ii. Supply side long-run test results

Table 5.3.5 below provides the empirical long run results for the supply side model. The purpose of this section is to test if each explanatory variable has a long run relationship with PSCE or not and confirm if the relationship is negative or positive.

Table 5.3.5 ARDL long-run test results

Variable	Coefficient	Std Error	t-statistic	Prob
LGDP1	0.4659***	0.1482	3.1427	0.0021
LPRP1	-0.0014	0.0024	-0.5873	0.5581
LINTR1	-0.0054	0.0280	-0.1945	0.8461
LBD1	0.6822***	0.0967	7.0559	0.0000
LGDEF1	-0.0951	0.0013	-0.0754	0.9400
C	-0.0031	0.0046	-0.6773	0.4996

GDP is positively related to PSCE in the long run, and it is statistically significant at 1% level of significance. In the long run, a 1% increase in GDP will lead to a 0.4659 increase in PSCE. This finding is in line with earlier findings of Akpansung and Babilola (2011), Chukwuemeka et al.

(2012), Arsene and Guy-Paulin (2013), Ayano (2014), and Hakwashika (2018), who also found GDP to be positively related to PSCE. South Africa's GDP has not been growing at the desired levels over the past 30 years. The country has been growing at relatively low levels with an average growth rate of 2.07% between 1990 and 2021. The lowest growth rate of -6% was experienced in 2020 during the COVID-19 global pandemic, which saw many economies contracting due a halt in economic activities, and the highest growth rate of 5.6% was experienced in 2006. For most parts of the period under study, the country has not achieved a growth rate above 5%; this explains the minimal growth rates in PSCE given the positive relationship between the two variables.

BD is positively related to PSCE in the long run, and it is statistically significant at 1% level of significance. In the long run, a 1% increase in BD will lead to a 0.6822 increase in PSCE. This finding is in support of the findings of Assefa (2014), James (2015), Temesgen (2016), Damane and Molapo (2017), and Da Chuna et al. (2020), who also found BD to be positively related to PSCE. South African deposit taking lenders appear to have a deposit taking capacity. The country recorded the lowest deposit of R554 212 (billions) in 1990 and the highest deposit of R16 814 994 (billions) in 2021. The country's deposits have been growing year on year, for the duration of the study. Deposit taking lenders are receiving sufficient deposits from the public. This implies that banks have sufficient resources to create more credit through the money multiplier given the country's minimal reserve requirement of around 2.5%.

Lastly, property prices, interest rates (INTR) and GDEF have been found to be statistically insignificant and therefore do not affect credit extension based on our empirical results.

iii. Supply side short-run results

The following table provides the empirical short-run results for the supply side model. The purpose of the table is to confirm the short-run relationship between PSCE and its explanatory variables, and to confirm if the impact is positive or negative.

Table 5.3.6 ARDL short-run test results

Variables	coefficient	Standard error	T -statistic	Probability
LPSCE1 (-1)	0.4849***	0.0675	7.1863	0.0000
LGDP1	0.0796**	0.0376	2.1170	0.0364
LGDP1 (-1)	0.1050***	0.0372	2.8231	0.0056
LGDP1 (-2)	0.0554	0.0361	1.5326	0.1281
LPRP1	-0.0007	0.0012	-0.5920	0.5550
LINTR1	-0.0028	0.0144	-0.1950	0.8457
LBD1	0.3514***	0.0590	5.9573	0.0000
LGDEF1	-4.0089	0.0006	-0.0754	0.9400
C	-0.0016	0.0023	-0.6875	0.4932
ECM	-0.5151***	0.0627	-8.2218	0.0000
R-squared	0.7097	Mean dependent var	0.0260	
Adjusted R-squared	0.6897	S.D. dependent var	0.0165	
S.E. of regression	0.0092	Akaike info criterion	-6.4701	
Sum squared residual	0.0098	Schwarz criterion	-6.2664	
Log likelihood	413.3748	Hannan-Quinn criterion	-6.3873	
F-statistic	35.4526	Durbin-Watson stat	2.2181	
Prob (F-statistic)	0.0000			

Note: *, ** and *** denote level of significance at 10%, 5% and 1% respectively.

The results are obtained using e-views software version 12

Both GDP and GDP (-2) are found to have a positive and significant impact on PSCE. Regarding GDP, a 1% increase in GDP will lead to a 0.0796 increase in PSCE. GDP (-1) means that a 1% increase in GDP, one quarter (3 months) ago, will increase PSCE by 0.1050 in the current period. The biggest impact of GDP on PSCE is seen at lag (-1) where PSCE increased by 0.1050 compared with 0.0796 without a lag. The finding on GDP without a lag is in support of earlier findings by Calza et al. (2003), Al Daia et al. (2011), Guo and Stepanyan (2011), and Adeleke and Awodumi (2018). Our findings are unique in the sense that we found GDP (-1) also has a positive impact on PSCE.

BD is statistically significant and positively related to PSCE in the short run at 1%, level of significance. In the short-run, a 1% increase in bank deposit will lead to a 0.3514 increase in PSCE. This finding is in support of earlier findings of Eller et al. (2010), Al Daia et al. (2011), Gounder and Sharma (2012), and Imran and Nishat (2013), who also found BD to be positively related to PSCE. PP, INTR and GDEF have been found to be statistically insignificant. Lastly, the ECM of -0.5151 implies that equilibrium will be restored at a speed of adjustment of 0.5151 in the long run.

There are similarities in the long-run and short-run empirical findings. Both the long-run and short-run results found that only GDP and BD are significant and are positively related to PSCE, while the long run and short run results established that PP, INTR and GDEF are statistically insignificant.

5.3.2.3 Diagnostic tests

This section presents and discusses the post estimation diagnostic tests that are conducted to confirm whether heteroscedasticity, serial correlation, and multicollinearity are present in the data. Furthermore, the section also tests for model specification, normality, and stability. All these post estimation tests are performed to confirm the behaviour of the model following the estimation done in the previous sections.

i. Goodness of fit

The R-squared of 71% implies that the model is of good fit. This further implies that the chosen model is robust and will not crash during the period of the study.

ii. Heteroscedasticity Test

Table 5.3.7 Tests for heteroscedasticity

Tests	Null Hypothesis (H_0)	P-value	Conclusion
Breusch-Pagan-Godfrey	Heteroscedasticity is present	0.4728	Reject (H_0)
Harvey	Heteroscedasticity is present	0.1047	Reject (H_0)
Glejser	Heteroscedasticity is present	0.3751	Reject (H_0)
ARCH	Heteroscedasticity is present	0.1616	Reject (H_0)

Heteroscedasticity can be tested for, using various tests. We have chosen four of the five famous tests to check for the presence of heteroscedasticity in the data. The tests are the Breusch-Pagan-Godfrey, the Harvey, the Glejser and the ARCH LM tests. The null hypothesis states that heteroscedasticity is present. We reject the null hypothesis should the observed R-squared p-value be more than the 0.05 or 5%. All four tests revealed that data is homoscedastic with p-values of 0.4728, 0.1047, 0.3751 and 0.1616, respectively.

iii. Test for serial correlation

Table 5.3.8 Test for serial correlation

Test	*Null Hypothesis (H_0)*	*P-value*	*Conclusion*
Breusch-Godfrey LM Test	There is serial correlation	0.2795	Reject (H_0)

We employ the same approach as that on the demand side model and have chosen to adopt the Breush-Godfrey LM test to test for serial correlation. The null hypothesis states that the series is serially correlated. We compare the observed R-squared or probability chi-squared with 0.05 or 5% level of significance. We reject the null hypothesis based on the p-value of 0.2795. This implies that the data is not serially correlated.

iv. Test for multicolinearity

Table 5.3.9 Test for multicolinearity

Variables	Centered VIF	Null Hypothesis (H_0)	Conclusion
PSCE	1.8171	No Severe Multicolinearity	Do not Reject (H_0)
GDP	1.2939	No Severe Multicolinearity	Do not Reject (H_0)
PRP	1.0150	No Severe Multicolinearity	Do not Reject (H_0)
INTR	1.2687	No Severe Multicolinearity	Do not Reject (H_0)
BD	1.6516	No Severe Multicolinearity	Do not Reject (H_0)
GDEF	1.0234	No Severe Multicolinearity	Do not Reject (H_0)

We test for multicollinearity by checking the value of centered VIF. The null hypothesis states that there is no severe multicollinearity in the model. The rejection rule is based on checking the value of the VIF. The null hypothesis will be rejected should the value of the centered VIF be more than 10. The centered VIF value for PSCE is 1.8171, 1.2939 for GDP, 1.0150 for PRP, 1.2687 for INTR, 1.6516 for BD, and 1.0234 for GDEF. The null hypothesis is rejected based on the reported centered VIF values. This implies that there is no severe multicollinearity in the model.

v. Specification test

Table 5.3.10 Test for specification

Test	*Null Hypothesis (H_0)*	*P-value*	*Conclusion*
Ramsey RESET	Model is correctly specified	0.6349	Do not reject (H_0)

The study will employ the Ramsey RESET test to test for model specification. The null hypothesis states that the model is correctly specified. The Ramsey RESET p-value of 0.6349 leads to the null hypothesis not being rejected. This implies that the model is correctly specified.

vi. Normality test

Figure 5.3.1 Test for normality (histogram of residuals)

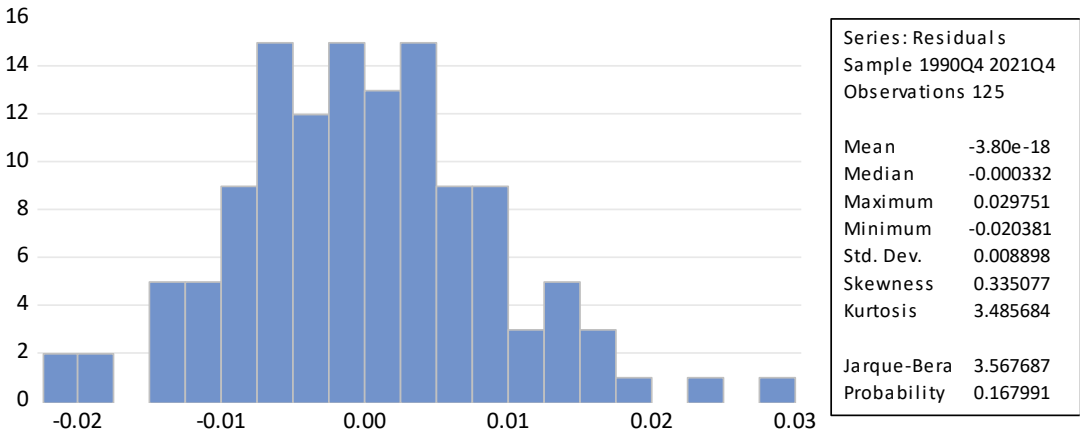


Table 5.3.11 Test for normality

Test	*Null Hypothesis (H_0)*	*Jarque-Bera value*	*P-*	*Conclusion*
Jarque-Bera	Residuals are normally distributed	0.1680		Do not Reject (H_0)

The study employs two methods to test for normality. The methods are the virtual and non-virtual tests. The virtual test is known as the histogram of residuals and the non-virtual test is known as the Jarque-Bera test. The null hypothesis states that the residuals are normally

distributed. We start with the histogram of residuals where the researcher mentally superimposes the bell-shaped normal distribution curve on the histogram in figure 5.3.1. We then proceed to check the Jarque-Bera test statistical probability value of 0.1680, which implies that the residuals are normally distributed.

vii. Stability tests

Figure 5.3.2 CUSUM test

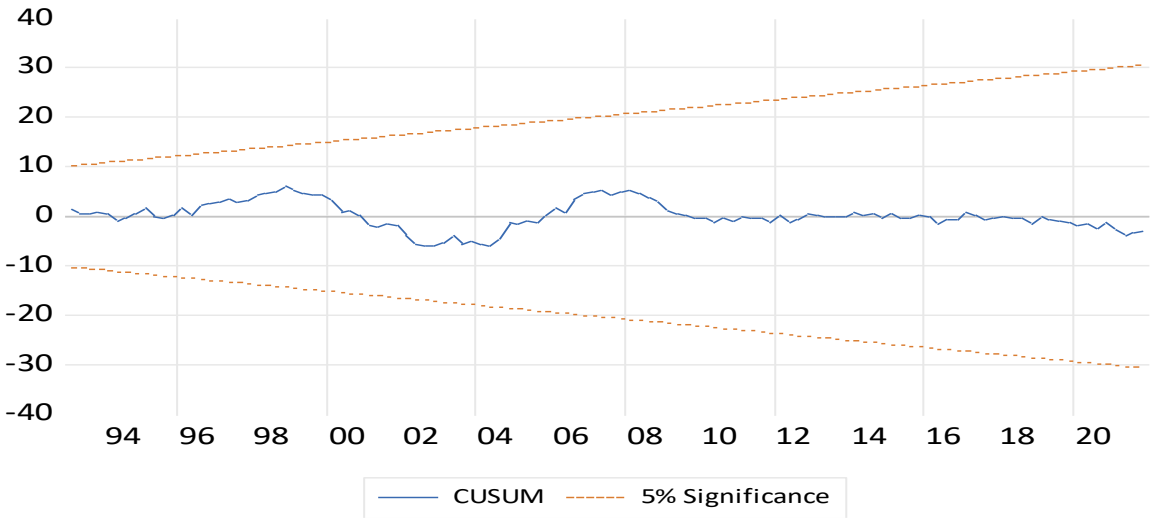
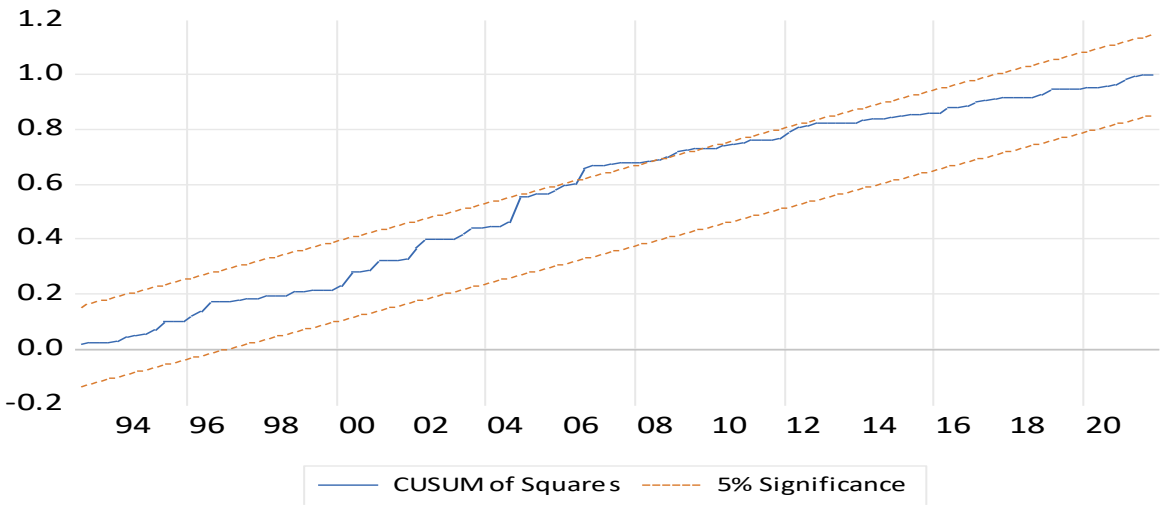


Figure 5.3.3 CUSUM of squares test



We start with the CUSUM stability test on figure 5.3.2. The null hypothesis states that there is variance stability in the model. We do not reject the null hypothesis based on the CUSUM recursive residuals moving within the upper and lower critical lines at 5% level of significance

as reflected in figure 5.3.2. We then proceed with the CUSUM of squares stability test as reflected in figure 5.3.3. The CUSUM of squares test reflects relative variance stability from 1990 to 2006, and variance instability from 2007 to 2010. The variance stability is restored from 2011 to the end of 2021.

5.3.2.4 Sensitivity Analysis

The previous section suggested that there may be potential structural breaks in the series as reflected in the CUSUM of squares stability test, which reflected variance instability from 2007 to 2010. This section investigates whether the results will be different if we account for structural breaks in our model. As pointed out in section 5.2.2.4, the global economy was faced with a financial crisis between 2007 and 2009, and South Africa was no exception to this crisis. The breakpoint unit root test results reveal that INTR is stationary at level, while PSCE, GDP, PRP, BD and GDEF are stationary at first difference. Having established that the supply side variables are stationary at level and first difference, we proceed to estimate the following equation:

$$\Delta \ln PSCE(S)_t = \beta_0 + \beta_1 DUM_t + \sum_{i=1}^{P} \beta_2 \Delta \ln PSCE_{t-1} + \sum_{i=0}^{P} \beta_3 \Delta \ln GDP_{t-1} + \sum_{i=0}^{P} \beta_4 \Delta \ln PRP_{t-1} + \sum_{i=0}^{P} \beta_5 \Delta \ln INTR_{t-1} + \sum_{i=0}^{P} \beta_6 \Delta \ln BD_{t-1} + \sum_{i=0}^{P} \beta_7 \Delta GDEF_{t-1} + \delta_1 \ln PSCE_{t-1} + \delta_2 \ln GDP_{t-1} + \delta_3 \ln PRP_{t-1} + \delta_4 \ln INTR_{t-1} + \delta_5 \ln BD_{t-1} + \delta_6 \ln GDEF_{t-1} \varepsilon_t \quad \text{Equation 5.4}$$

Table 5.3.12 Unit root tests with structural breaks

Stationarity of all variables at level				Stationarity of all variables at first difference		
Variable	Trend and Intercept	Lag	Break date	Trend and Intercept	Lag	Break date
Zivot-Andrews test						
$\ln PSCE$	-4.6127	1	2005Q4	-4.9899*	1	2008Q2

lnGDP	-3.1117	4	2007Q1	-8.4998***	3	2008Q4
lnPRP	-4.5896	4	1997Q2	-12.9947***	3	1999Q1
lnINTR	-4.0570	1	1998Q4	-8.4536***	0	1998Q4
lnBD	-5.6240***	3	2006Q1	na	na	na
lnGDEF	-5.3938**	3	2009Q2	na	na	na
Perron test						
ln$PSCE$	-4.5937	1	2005Q3	-6.0458**	0	2008Q1
lnGDP	-3.0962	4	2006Q4	-11.0152***	1	1999Q2
lnPRP	-4.5754	4	1997Q1	-13.4246***	3	1995Q3
lnINTR	-4.6408	1	1998Q3	-8.9855***	0	1998Q3
lnBD	-5.0308	1	2005Q4	-8.1060***	0	2008Q1
lnGDEF	-5.6614**	3	2009Q1	na	na	na
Notes *, ** & *** indicate the 10%, 5% & 1% level of significance respectively. I(0) represents stationarity at level and I(1) represents stationarity at first difference.						

Table 5.3.13 Bounds testing with structural breaks

F-Bounds Test				
Test Statistic	Value	Significance	LCB	UCB
				Asymptotic: n=1000
F-Statistic	4.5390	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99
	Note: LCB represents Lower Critical Bound and UCB represents Upper Critical Bound. K represents the independent variables employed in the model.			

Table 5.3.14 long run results with structural breaks

Variable	Coefficient	Std Error	t-statistic	Prob
DUM	-0.0361*	0.0193	-1.8679	0.0645
LGDP1	0.6233***	0.1834	3.3995	0.0009
LPRP1	-0.0015	0.0021	-0.6852	0.4947
LINTR1	-0.0030	0.0243	-0.1216	0.9035
LBD1	0.5978***	0.0901	6.6321	0.0000
LGDEF1	-0.0024	0.0016	-1.4769	0.1426
C	-0.0022	0.0055	-0.3931	0.6950

Table 5.3.15 short run results with structural breaks

Variables	coefficient	Standard error	T -statistic	Probability
LPSCE1 (-1)	0.4338***	0.0695	6.2403	0.0000
DUM	0.0016	0.0082	0.1990	0.8427
DUM (-1)	-0.0091	0.0099	-0.9161	0.3616
DUM (-2)	0.0038	0.0098	0.3931	0.6950
DUM (-3)	-0.0168**	0.0085	-1.9840	0.0498
LGDP1	0.0745**	0.0363	2.0493	0.0429
LGDP1(-1)	0.0918**	0.0368	2.4948	0.0141
LGDP1(-2)	0.0647*	0.0372	1.7382	0.0850
LGDP1(-3)	0.0423	0.0365	1.1601	0.2486
LGDP1(-4)	0.0797**	0.0343	2.3202	0.0222
LPRP1	-0.0008	0.0012	-0.6910	0.4911
LINTR1	-0.0017	0.0137	-0.1217	0.9034
LBD1	0.3385***	0.0583	5.8068	0.0000
LGDEF1	-0.0013	0.0009	-1.4508	0.1497
C	-0.0012	0.0031	-0.3949	0.6937
ECM	-0.4916***	0.0883	-5.5646	0.0000
R-squared	0.7477	Mean dependent variable		0.0257

Adjusted R-squared	0.7150	S.D. dependent variable	0.0164
S.E. of regression	0.0088	Akaike info criterion	-6.5223
Sum squared residual	0.0083	Schwarz criterion	-6.1794
Log likelihood	416.1234	Hannan-Quinn criterion	-6.3830
F-statistic	22.8653	Durbin-Watson statistics	2.2920
Prob (F-statistic)	0.0000		

Note: *, ** and *** denote level of significance at 10%, 5% and 1% respectively.

The results are obtained using e-views software version 12.

Table 5.3.16 Summary of post diagnostic results with structural breaks

Test	T-statistics	P-value
Heteroscedasticity	12.1899	0.5911
Serial correlation	4.2479	0.1196
Normality	4.8884	0.0868
Model Specification	0.2473	0.8052

Equation 5.4 is similar to equation 5.3, except that a dummy variable (DUM) is included in equation 5.4. The Perron unit root test detected a break in PSCE in 2008Q1, while the Zivot-Andrews unit root test detected a break in PSCE in 2008Q2. This implies that DUM will take the value of one in 2008Q1 and 2008Q2, and the value of zero for the other years.

The results of the ARDL bounds test for cointegration reveal that the calculated F-statistic is 4.5390, which is higher than the critical values reported in table 5.3.13 at 1% level of significance. This implies that the variables in the model are cointegrated. We proceed to estimate the model by choosing optimal lag length based on AIC. The selected model is ARDL (1, 3, 4, 0, 0, 0, 0). Table 5.3.13 and table 5.3.14 report the long run and short run results of the ARDL model with structural breaks.

Similar to the main results, the long run regression results with structural breaks accounted for by a dummy variable, reveal that GDP and BD are positively related to PSCE. The short run results are also consistent with the main results as they have established that GDP and BD are positively related to PSCE. The only difference is that the results with structural breaks found that GDP has a positive impact on PSCE in lag 1 and lag 2, while the main results only found a positive impact in lag 1.

The selected ARDL model fits well as supported by the R-squared value of 74.77%. The estimates are reliable as the model is free from heteroscedasticity, serial correlation, and model misspecification. In addition, the CUSUM and CUSUM of squares pass the stability tests. Based on the above findings, it is evident that the main results are reliable compared with the results with structural breaks. Lastly, the structural break detected in 2008Q1 and 2008Q2 can be ascribed to the 2008 Global Financial Crisis. This break did not have permanent effects as our model regains stability from the breakpoints to 2021Q4.

5.4 CONCLUSION

This chapter sought to answer the research questions and hypotheses raised in chapter 1. This was done by applying the methodology described in chapter 4. The application of the ARDL method required that the variables be integrated of either I (0), I (1) or a combination of both. The study analysed the determinants of the private sector from both the demand and the supply sides and developed a regression model for each side (demand and supply) of PSCE. This chapter was split into two main sections, namely, the demand side empirical results and the supply side empirical results.

On the demand side, we started with descriptive statistics and proceeded to unit root testing where we confirmed that all variables are integrated of I (0) and I (1) and this paved a way for the researcher to proceed with employing the ARDL method. The next step was to test for cointegration through the bound test, which revealed that our demand side variables are cointegrated and proceeded to test for long-run and short-run relationships. The demand side model had seven independent variables (GDP, INTR, INFL, REER, PRP, RWR and PUBSC) and both the long run and short run results revealed that only four (INFL, PP, RWR and PUBSC) out of the seven demand side variables are statistically significant in the long run. A similarity between the long-run and short-run was noted and it revealed that INFL and PUBSC are

negatively related to PSCE, while PRP and RWR were found to be positively related to PSCE, in both long-run and short-run results.

Similarly, the variables (GDP, INTR and REER) that were found to be statistically insignificant in the long run, were also found to be statistically insignificant in the short run. The first section ended with post estimation diagnostic tests, which revealed that our demand side model has no heteroscedasticity, no serial correlation, and no multicollinearity. The diagnostic tests further revealed that the model is correctly specified and that the disturbances are normally distributed. Lastly, the diagnostic tests revealed that the model is stable during the period of the study.

On the supply side, we started with descriptive statistics and proceeded with unit root testing, which confirmed that our variables are integrated of both order 0 and order 1. The unit root testing was followed by cointegration through the bound test, which revealed that the supply side variables are cointegrated. We proceeded to test for long-run and short-run relationships. The supply side model had five independent variables (GDP, PP, INTR, BD and GDEF) and the results revealed that only two (GDP and BD) out of the five supply side variables are statistically significant. Like the demand side, a similarity between the long-run and short-run results was also noted; it revealed that GDP and BD are positively related to PSCE in both the long-run and the short-run periods. Likewise, PP, INTR and GDEF were found to be statistically insignificant in both the long-run and the short-run results. The section was concluded with post estimation diagnostic tests, which revealed that our supply side model has no heteroscedasticity, no serial correlation, and no multicollinearity. The diagnostic tests further revealed that the model is correctly specified and that the disturbances are normally distributed. Lastly, the diagnostic tests revealed that the model is stable during the period of the study.

Lastly, an interesting finding is on the positive impact of GDP on PSCE. Although the same data was employed on both the demand and supply side for GDP, the supply side established a positive relationship between GDP and PSCE, while GDP was found to be statistically insignificant on the demand side. Supply side GDP revealed an impact on PSCE without a lag and at lag (-1). The same data was also employed INTR on the demand and supply side and both models produced the same results (i.e., statistically insignificant).

CHAPTER 6: CONCLUSION, POLICY IMPLICATIONS AND RECOMMENDATIONS, AND AREAS FOR FURTHER RESEARCH

6.1 INTRODUCTION

This chapter serves to conclude the study, which empirically examined the determinants of PSCE from the demand and supply sides in South Africa. The chapter has four sections and begins with a summary of the study in section 6.2, accompanied by a summary of the empirical findings in section 6.3. Section 6.4 discusses policy implications and recommendations. Section 6.5 completes the chapter with a discussion of the limitations and suggested areas for future research.

6.2 SUMMARY OF THE STUDY

The study empirically examined the determinants of PSCE in South Africa. The purpose of the study was achieved through four individual objectives. The first objective was to explore the development of private sector credit in South Africa during 1990Q1 to 2021Q4. The second objective was to review the theoretical and empirical literature on PSCE from both the demand and supply side perspectives. The third objective was to ascertain the long and short run relationship between private sector credit and its determinants in South Africa from a demand perspective during 1990Q1 to 2021Q4. Lastly, the fourth objective was to ascertain the long and short run relationship between private sector credit and its determinants in South Africa from a supply perspective during 1990Q1 to 2021Q4.

The study was mainly focused on analysing the determinants of PSCE in South Africa. This was achieved through the objectives that were addressed in different chapters in the study, where each preceding chapter served as a building block for subsequent chapters. The study was chosen for four specific reasons. The first reason is that credit extension is argued to be an important element in the monetary transmission mechanism, which enables economic agents to participate effectively, and contributes to the economy by enabling economic agents to produce and consume essential goods and services required for the day-to-day livelihood of all citizens. The second reason is that the small business failure rate is ascribed to the lack of credit in and across Africa and South Africa, which is also prone to this economic hurdle. This prompted the researcher to comprehensively dissect what determines credit from both the demand and supply sides to recommend appropriate measures that borrowers and lenders

can adopt to address this challenge. The third reason is that studies that analyse both the demand and supply side determinants in Africa and South Africa are limited. This prevents policy makers from fully understanding, from which side, policy implementation and reforms are required to grow our economy at desired levels. Lastly, empirical literature did not establish a consensus on the impact of determinants such as inflation, which was found to be both positive and negative in various economies. The study was intended to establish conclusive results on such variables, in the context of South Africa.

The first objective of analysing the trends of PSCE in South Africa was achieved in chapter two where we discussed and analysed trends by discussing how PSCE was behaving before and during the 2008 global financial crisis. This was followed by a discussion on the trends of PSCE in relation to changes in sovereign credit ratings and lastly, by analysing the behavior (changes) of PSCE during the COVID-19 global pandemic. The second objective was to review and discuss the possible determinants of PSCE in South Africa. This was achieved in chapter three, which discussed theoretical and empirical determinants by reviewing literature across the globe, Africa, and the limited literature from South Africa.

Chapter four was a precondition for achieving objectives three and four because a research methodology to be employed was discussed in chapter four. However, the identification of a suitable methodology was based on literature reviewed in chapter three, which proved that previous researchers successfully employed the same methodology and produced reliable results. In addition, chapter four thoroughly discussed and justified the methodology and chosen variables and established the reliability of the chosen methodology. The third objective of determining and analysing the long run and short run relationship between PSCE and its selected demand side variables was achieved through chapter five, which presented and analysed empirical results by employing the methodology discussed in its preceding chapter (chapter 4).

Lastly, the fourth objective of determining and analysing the long and short run relationship between PSCE and its selected supply side variables was similarly achieved through the employment of the ARDL model developed by Pesaran and Shin (1997), and later augmented by Pesaran, Shin and Smith (2001). The application of the ARDL model discussed in chapter four proved to be reliable because the last section (post estimation diagnostic tests) of chapter five established that both the demand and supply side models were of good fit,

correctly specified, and remained stable during the period of the study, which covered three decades (from 1990Q1 to 2021Q4).

In closing, there are two unique attributes that separate this study from most studies conducted on this topic. Firstly, PSCE was analysed from both the demand and supply side, and secondly, we included lags in our empirical results. This is another attribute that most studies that analysed the determinants of PSCE did not include. All the objectives of the study were achieved by sequentially linking chapter two, three, four and five, and by using each preceding chapter as a building block necessary to enable the researcher to reach the objectives laid out in chapter one. The empirical findings conducted in chapter five are summarised in section 6.3 below and paved the way for the study to be concluded with chapter six.

6.3 SUMMARY OF THE EMPIRICAL FINDINGS

The demand side empirical findings revealed the following:

i. Both long-run and short-run empirical results found that four explanatory variables (INFL, PRP, RWR and PUBSC) were statistically significant and have a long-run and short-run relationship with PSCE.

ii. Both long-run and short-run empirical results found that three explanatory variables (GDP, INTR and REER) were statistically insignificant.

iii. INFL and PUBSC have a significant negative short-run and long-run impact on PSCE. This implies that South African borrowers are sensitive to high interest rates, which come with high inflation and consequently reduces credit demand. On the other hand, the negative impact of PUBSC on PSCE implies that the crowding out effect is prevalent in South Africa, meaning that credit extended to the public sector reduces funds available for the private sector.

iv. PRP and RWR have a significant positive short run and long run impact on PSCE. The PRP impact implies that the South African private sector demands more credit as the values of their properties increase, because fixed property is often used as collateral and increases the chances of a borrower (particularly business customers) obtaining loans. The impact of real wage rate implies that individual borrowers demand more credit as the wage rate increases because it improves their disposable income, which

ultimately improves repayment ability of a loan obtainable from formal lending institutions.

v. In closing, INFL has a stronger impact (0.0144) on PSCE in the long-run, compared to the minimal (0.0041) impact established in the short-run period. PUBSC has a stronger impact (0.0064) on PSCE in the long-run, compared to the minimal impact (0.0014) established in the short-run period. PRP has a stronger impact (0.068) in the long-run, compared to the minimal impact of 0.0142 and 0.0083, established in PRP (-2) and PRP (-3), respectively, in the short-run period. RWR has a substantially stronger impact (0.8495) on PSCE in the long-run, compared to the relatively minimal impact of 0.0961, 0.0544 and 0.0619 established in RWR (-1), RWR (-2) and RWR (-3), respectively, in the short run.

The supply side empirical findings revealed the following:

i. Both long and short-run empirical results found that only two (GDP and BD) explanatory variables were statistically significant and have a long and short run relationship with PSCE.

ii. Both long-run and short-run empirical results found that three explanatory variables (INTR and GDEF) were statistically insignificant.

iii. GDP has a significant positive short-run and long-run impact on PSCE. This implies that South African lending institutions react positively to an improved GDP. They subsequently relax their credit risk policies and ultimately increase the supply of credit available for extension to the private sector.

iv. BD has a significant positive short-run and long-run impact on PSCE. This implies and suggests that the South African deposit-taking lending institutions increase money supply with increases in deposits held with them. Consequently, deposits are used by deposit-taking lending institutions to improve money supply through the money multiplier. The consequence of this is an increase in credit available for lending to the private sector because banks create credit either from deposits through the money multiplier, or against capital injected by their shareholders.

v. GDP has a stronger impact (0.4659) on PSCE in the long run, compared to the impact established in the short run period. GDP has an impact of 0.0796 with no lags and an impact of 0.1050 at GDP (-1). Bank Deposits have a stronger impact

(0.6822) on PSCE in the long run, compared to the relatively minimal impact (0.3514) established in the short run.

6.4 POLICY IMPLICATIONS AND RECOMMENDATIONS

The empirical results revealed that three determinants have the biggest impact on PSCE. From the demand side, the variable is real wage rate and from the supply side, the variables are GDP and Bank Deposits. Other variables have been found to have an impact as discussed in section 6.3, but due to the severity of the impact, we will only focus on the three variables described above for policy recommendations. Policy recommendation on improving PSCE is based on various benefits that credit has for borrowers and the overall economy. The benefit for firms is that credit can be used to start new projects, fund expansion, and bridge the cash flow gap. In support of this, Fatoki and Odeyemi (2010) highlighted that credit enables a business to grow and sustain the growth. The benefit for individual borrowers is that credit can be used to start businesses and purchase assets that one cannot afford to purchase with a single month's salary. Examples of such assets would be vehicles and property. In support of this statement, the DTI (2004) earlier noted that credit can benefit individual borrowers through student loans to study for qualifications that reward students with the skills required for performing certain jobs.

This study found that RWR has the highest impact on PSCE, implying that borrowers will demand more credit as real wage rate increases. Although South Africa has already taken the first necessary measure to ensure that there is fairness in wages, the national minimum wage is focused on nominal wage, which does not take inflation into consideration. The national minimum wage only became effective on 1 January 2019 (National Minimum Wage, 2018) and addresses part of the problem.

This study is focused on real wage rate and one of the economic challenges faced by South Africa, where there is a compelling need for South Africa to align skills to qualifications. Authors such as Daniel (2007) have highlighted that there is lack of coordination between the Department of Education and the Department of Labour. Real wage rate is often aligned to productivity, and productivity requires a skill that many graduates do not obtain during their studies. We recommend greater collaboration between the Department of Education, the private sector, the Department of Labour and other public sector employers to ensure

alignment between tertiary curriculum and qualifications. This can be done through the introduction of virtual simulation courses during the final stages of tertiary qualifications, which will improve the skills set of the graduates before entering the job market.

Secondly, Bank Deposits have the second largest impact on PSCE. Bank Deposits are obtained from the surplus units and ultimately, used by deposit-taking lending institutions to create credit. To boost the bank deposits, we recommend policies aimed at improving financial inclusiveness in South Africa. In 2021, the World Bank (2021) reported that South Africa is making notable progress with its drive to increase financial inclusion by implementing solutions that entice citizens to enter the financial system. The global lender highlighted that South Africa's account ownership (persons above 15 years) with a financial institution was reported at 85,38% at the end of 2021. This is great progress compared to the averages of 96,36% for high income countries, 72,37% for middle-income countries and 38,97% for low-income countries. International economies such as Denmark and Iceland were reported to have reached 100% of account ownership with financial institutions (World Bank 2021).

The above implies that, with great regulations and cost-effective banking solutions for all income earners, South Africa can reach 90%, and this will ultimately improve deposits held with financial institutions. The financial institutions have seen a rise in the use of savings and transactional accounts, but the use of credit cards, insurance and home loans has remained low. Therefore, government should provide resources and education to improve the financial literacy of the public. A practical example would be to introduce financial literacy as a compulsory subject from primary to secondary school. This will teach the youth to understand the importance of entering the formal financial system, bank their money, and create a good track record from an early age so that they can ultimately benefit from the financial systems when they become adults.

In addition, the South African government introduced ways to encourage savings through the implantation of tax-free investment accounts, which became effective on 1 March 2015 and had an annual limit of R36 000 for every individual (South African Revenue Service, 2021). The informal economy operates with cash, which rarely reaches financial institutions and the South African Revenue Services (SARS). Ensuring that a minimum of 90% of South Africa's citizens bank their income will improve deposits at banks and ultimately improve the chances of borrowers obtaining loans. Banking institutions find it hard to extend loans to borrowers

who do not have a proper track record that reflects proof of income flowing into a person's account and this leads to potential borrowers resorting to loan sharks. Finally, we recommend that the South African government, in collaboration with other stakeholders such as banks and trade unions, must introduce regulation that compels all employers to pay salaries through bank accounts only, as this will improve deposits and ultimately, financial inclusion.

The third determinant with the biggest impact on PSCE, is GDP. The study revealed that a rise in economic growth will lead to a substantial increase in PSCE. South Africa has been experiencing low economic growth rates over the past three decades, which covers the study period. Time series data from the SARB reveals that the country's GDP growth rate has never surpassed 6% over the study period. Monetary and fiscal authorities - such as the South African Reserve Bank and the National Treasury – have, over the years, stressed the importance of structural reforms aimed at improving economic growth. Since GPD growth is important to PSCE, we recommend that government provides policy and regulation intended to enhance the functioning of the economy, so that the private sector can grow smoothly. This will in turn increase GDP growth and, subsequently, improve PSCE.

6.5 LIMITATIONS AND SUGGESTED AREAS FOR FUTURE RESEARCH

The study employed quarterly time series data for a 31-year period between 1990Q1 and 2021Q4. Quarterly time series data for liquidity preference by banks in South Africa was unavailable. This resulted in the variable being dropped, which limited the study to only evaluating determinants of PSCE with available time series data. Liquidity preference by banks was reported to be a determinant of credit extension by Dow and Rodriguez-Fuentes (1997). This determinant is not measured in South Africa and limited the supply side variables.

In addition, the study design is quantitative as opposed to a qualitative or mixed methods research design; this also limits the analysis to secondary data, which can be prone to distortionary effects. Some demand and supply side determinants cannot be recorded in a time series format. An example of such determinants is credit risk policy, education of business owner, collateral, age of business, and gender of business owner. These types of determinants can only be analysed with qualitative or mixed methods studies as questionnaires need to be employed on both lenders and borrowers to obtain empirical

findings. Consequently, the quantitative design method limited the study from analysing more possible determinants because they do not have time series data world-wide.

The analysis of PSCE has not received enough attention in South Africa. Similarly, the analysis of both demand and supply determinants of PSCE has been scant in Africa. Some areas to be analysed by future researchers include the analysis of factors that hinder bank credit growth in the Southern African Development Community (SADC) (this to include main determinants such as non-performing loans, credit risk policies and liquidity preference of banks). The second area of future research is the analysis of credit rationing and the demand for credit by SMMEs. Lastly, another area of future research is the impact of credit risk policies on credit extension in South Africa. The above areas of prospective research are necessary for policy formulation aimed at strengthening the monetary transmission mechanism and ultimately improve the economic wellbeing of the South African private sector.

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8. Appendices

Appendix 8.1 Credit rating history by Standard and Poor ratings from 1993 to 2020

Standard & Poor Ratings (S&P)			
Date	**Rating**	**Outlook**	**Meaning/Description of Rating**
30 April 2020	BB-	Stable	Non-investment grade
22 November 2019	BB	Negative	Non-investment grade
24 November 2017	BB	Stable	Non-investment grade
3 April 2017	BB+	Negative	Lower medium grade
4 December 2015	BBB-	Negative	Lower medium grade
13 June 2014	BBB-	Stable	Lower medium grade
12 October 2012	BBB	Negative	Lower medium grade
28 March 2012	BBB+	Negative	Lower medium grade
25 January 2011	BBB+	Stable	Lower medium grade
11 November 2008	BBB+	Negative	Lower medium grade
1 August 2005	BBB+	Stable	Lower medium grade
7 May 2003	BBB	Stable	Lower medium grade
12 November 2002	BBB-	Positive	Lower medium grade
25 February 2000	BBB-	Stable	Lower medium grade
20 November 1995	BB+	Stable	Lower medium grade
3 October 1993	BB	Stable	Non-investment grade

Source: Trading Economies (2021)

Appendix 8.2 Credit rating history by Fitch ratings from 1994 to 2021

Fitch Ratings			
Date	**Rating**	**Outlook**	**Description of Rating**
15 December 2021	BB-	Stable	Non-investment grade
20 November 2020	BB-	Negative	Non-investment grade

3 April 2020	BB	Negative	Non-investment grade
26 July 2019	BB+	Negative	Non-investment grade
7 April 2017	BB+	Stable	Lower medium grade
25 November 2016	BBB-	Negative	Lower medium grade
4 December 2015	BBB-	stable	Lower medium grade
13 June 2013	BBB	Negative	Lower medium grade
10 January 2013	BBB	Stable	Lower medium grade
13 January 2012	BBB+	Negative	Lower medium grade
17 January 2011	BBB+	Stable	Lower medium grade
9 November 2008	BBB+	Negative	Lower medium grade
17 June 2008	BBB+	Stable	Lower medium grade
25 July 2007	BBB+	Positive	Lower medium grade
25 August 2005	BBB+	Stable	Lower medium grade
21 October 2004	BBB	Positive	Lower medium grade
2 May 2003	BBB	Stable	Lower medium grade
11 March 2003	BBB-	Positive Watch	Lower medium grade
20 August 2002	BBB-	Positive	Lower medium grade
21 September 2000	BBB-	Stable	Lower medium grade
17 June 2000	BBB-	N/A	Lower medium grade
19 May 2000	BB+	N/A	Lower medium grade
28 May 1998	BB	N/A	Non-investment grade
17 February 1998	BB	Positive Watch	Non-investment grade
22 September 1994	BB	N/A	Non-investment grade

Source: Trading Economies (2021)

Appendix 8.3 Credit rating history by Moody's Investor Services from 1994 to 2020

Moody's Investor Services			
Date	**Rating**	**Outlook**	**Description of Rating**
20 November 2020	Ba2	Negative	Non-Investment Grade
27 March 2020	Ba1	Negative	Non-Investment Grade
1 November 2019	Baa3	Negative	Lower medium grade
23 March 2018	Baa3	Stable	Lower medium grade
24 November 2017	Baa3	Under Review	Lower medium grade
9 June 2017	Baa3	Negative	Lower medium grade
3 April 2017	Baa2	Negative Watch	Lower medium grade
8 March 2016	Baa2	Negative Watch	Lower medium grade
6 May 2016	Baa2	Negative	Lower medium grade
4 November 2014	Baa2	Negative	Lower medium grade
27 September 2012	Baa1	Negative	Lower medium grade
9 November 2011	A3	Negative	Upper medium grade
16 July 2009	A3	Stable	Upper medium grade
5 June 2007	Baa1	Positive	Lower medium grade
11 Jan 2005	Baa1	Stable	Lower medium grade
14 October 2004	Baa2	Positive Watch	Lower medium grade
26 February 2003	Baa2	Positive	Lower medium grade
29 November 2001	Baa2	Stable	Lower medium grade
12 October 2001	Baa3	Positive Watch	Lower medium grade
7 February 2000	Baa3	Positive	Lower medium grade
8 October 1998	Baa3	Stable	Lower medium grade
17 July 1998	Baa3	Negative Watch	Lower medium grade

3 October 1994	Baa3	Stable	Lower medium grade

Source: Trading Economies (2021)

Appendix 8.4 Credit ratings description explained for three major rating agencies

TE	Standard and Poor Ratings	Moody's Investor Services	Fitch Ratings	Description
100	AAA	Aaa	AAA	Prime
95	AA+	Aa1	AA+	High grade
90	AA	Aa2	AA	
85	AA-	Aa3	AA-	
80	A+	A1	A+	Upper medium grade
75	A	A2	A	
70	A-	A3	A-	
65	BBB+	Baa1	BBB+	Lower medium grade
60	BBB	Baa2	BBB	
55	BBB-	Baa3	BBB-	
50	BB+	Ba1	BB+	Non-Investment grade speculative
45	BB	Ba2	BB	
40	BB-	Ba3	BB-	
35	B+	B1	B+	Highly speculative
30	B	B2	B	
25	B-	B3	B-	
20	CCC+	Caa1	CCC	Substantial risks
15	CCC	Caa2		Extremely speculative
10	CCC-	Caa3		In default with little prospect for recovery
	CC	Ca		
5	C	C		
0	D	/	DDD	In default

Source: Trading Economics 2021

Appendix 8.5 demand side e-views empirical results

Unit root tests

Null Hypothesis: LPSCE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.329715	0.9890
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPSCE)
Method: Least Squares
Date: 01/23/23 Time: 23:02
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE(-1)	-0.001982	0.006012	-0.329715	0.7422
D(LPSCE(-1))	0.710213	0.066920	10.61292	0.0000
C	0.037455	0.077854	0.481086	0.6313
@TREND("1990Q1")	-8.21E-06	0.000174	-0.047139	0.9625

R-squared	0.613698	Mean dependent var	0.025993
Adjusted R-squared	0.604199	S.D. dependent var	0.016452
S.E. of regression	0.010350	Akaike info criterion	-6.272382
Sum squared resid	0.013070	Schwarz criterion	-6.182341
Log likelihood	399.1601	Hannan-Quinn criter.	-6.235801
F-statistic	64.60513	Durbin-Watson stat	2.202599
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPSCE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.627501	0.0014
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPSCE,2)
Method: Least Squares
Date: 01/23/23 Time: 23:04
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPSCE(-1))	-0.296012	0.063968	-4.627501	0.0000
C	0.011806	0.003173	3.721380	0.0003
@TREND("1990Q1")	-6.48E-05	2.88E-05	-2.250331	0.0262

R-squared	0.148285	Mean dependent var	-9.85E-05
Adjusted R-squared	0.134436	S.D. dependent var	0.011085
S.E. of regression	0.010313	Akaike info criterion	-6.287364
Sum squared resid	0.013081	Schwarz criterion	-6.219834
Log likelihood	399.1039	Hannan-Quinn criter.	-6.259929
F-statistic	10.70729	Durbin-Watson stat	2.190451
Prob(F-statistic)	0.000052		

Null Hypothesis: LPSCE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.118869	0.9972
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000198
HAC corrected variance (Bartlett kernel)	0.000921

Phillips-Perron Test Equation
Dependent Variable: D(LPSCE)
Method: Least Squares
Date: 01/23/23 Time: 23:14
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE(-1)	0.016314	0.007903	2.064119	0.0411
C	-0.173310	0.103248	-1.678585	0.0958
@TREND("1990Q1")	-0.000670	0.000224	-2.997356	0.0033

R-squared	0.256734	Mean dependent var	0.026035
Adjusted R-squared	0.244746	S.D. dependent var	0.016393
S.E. of regression	0.014246	Akaike info criterion	-5.641276
Sum squared resid	0.025167	Schwarz criterion	-5.574090
Log likelihood	361.2210	Hannan-Quinn criter.	-5.613979
F-statistic	21.41565	Durbin-Watson stat	0.620668
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPSCE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.747201	0.0009
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000104
HAC corrected variance (Bartlett kernel)	0.000111

Phillips-Perron Test Equation
Dependent Variable: D(LPSCE,2)
Method: Least Squares
Date: 01/23/23 Time: 23:15
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPSCE(-1))	-0.296012	0.063968	-4.627501	0.0000
C	0.011806	0.003173	3.721380	0.0003
@TREND("1990Q1")	-6.48E-05	2.88E-05	-2.250331	0.0262

R-squared	0.148285	Mean dependent var	-9.85E-05
Adjusted R-squared	0.134436	S.D. dependent var	0.011085
S.E. of regression	0.010313	Akaike info criterion	-6.287364
Sum squared resid	0.013081	Schwarz criterion	-6.219834
Log likelihood	399.1039	Hannan-Quinn criter.	-6.259929
F-statistic	10.70729	Durbin-Watson stat	2.190451
Prob(F-statistic)	0.000052		

Null Hypothesis: LGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.113242	0.9942
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 02/01/23 Time: 22:10
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.002351	0.020757	-0.113242	0.9100
D(LGDP(-1))	-0.296344	0.087805	-3.375030	0.0010
C	0.073647	0.265844	0.277030	0.7822
@TREND("1990Q1")	-0.000148	0.000505	-0.293660	0.7695

R-squared	0.138120	Mean dependent var	0.023332
Adjusted R-squared	0.116926	S.D. dependent var	0.024940
S.E. of regression	0.023437	Akaike info criterion	-4.637797
Sum squared resid	0.067012	Schwarz criterion	-4.547757
Log likelihood	296.1812	Hannan-Quinn criter.	-4.601217
F-statistic	6.517017	Durbin-Watson stat	2.110888
Prob(F-statistic)	0.000399		

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.75898	0.0000
Test critical values:	1% level	-4.033108	
	5% level	-3.446168	
	10% level	-3.148049	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 02/01/23 Time: 22:12
Sample (adjusted): 1990Q4 2021Q4
Included observations: 125 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.548970	0.143970	-10.75898	0.0000
D(LGDP(-1),2)	0.193847	0.089491	2.166102	0.0323
C	0.051707	0.006432	8.038675	0.0000
@TREND("1990Q1")	-0.000240	6.13E-05	-3.919522	0.0001

R-squared	0.662074	Mean dependent var	-0.000207
Adjusted R-squared	0.653696	S.D. dependent var	0.039226
S.E. of regression	0.023084	Akaike info criterion	-4.667895
Sum squared resid	0.064476	Schwarz criterion	-4.577389
Log likelihood	295.7435	Hannan-Quinn criter.	-4.631127
F-statistic	79.02229	Durbin-Watson stat	2.032446
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 38 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.032861	0.9963
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000578
HAC corrected variance (Bartlett kernel)	0.000281

Phillips-Perron Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 02/01/23 Time: 22:15
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.013697	0.020983	-0.652790	0.5151
C	0.208984	0.269142	0.776484	0.4389
@TREND("1990Q1")	0.000175	0.000510	0.342866	0.7323

R-squared	0.056450	Mean dependent var	0.023350
Adjusted R-squared	0.041232	S.D. dependent var	0.024842
S.E. of regression	0.024324	Akaike info criterion	-4.571346
Sum squared resid	0.073367	Schwarz criterion	-4.504161
Log likelihood	293.2805	Hannan-Quinn criter.	-4.544049
F-statistic	3.709306	Durbin-Watson stat	2.568808
Prob(F-statistic)	0.027253		

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 27 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.56902	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000532
HAC corrected variance (Bartlett kernel)	0.000220

Phillips-Perron Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 02/01/23 Time: 22:16
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.298127	0.086034	-15.08856	0.0000
C	0.043548	0.005122	8.501939	0.0000
@TREND("1990Q1")	-0.000205	5.87E-05	-3.493817	0.0007

R-squared	0.649239	Mean dependent var	-7.68E-05
Adjusted R-squared	0.643535	S.D. dependent var	0.039097
S.E. of regression	0.023342	Akaike info criterion	-4.653565
Sum squared resid	0.067019	Schwarz criterion	-4.586035
Log likelihood	296.1746	Hannan-Quinn criter.	-4.626130
F-statistic	113.8329	Durbin-Watson stat	2.112479
Prob(F-statistic)	0.000000		

Null Hypothesis: LINTR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.369590	0.0602
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINTR)
Method: Least Squares
Date: 01/23/23 Time: 23:20
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINTR(-1)	-0.118717	0.035232	-3.369590	0.0010
D(LINTR(-1))	0.366061	0.084360	4.339263	0.0000
C	0.355601	0.107649	3.303326	0.0013
@TREND("1990Q1")	-0.000951	0.000314	-3.024119	0.0030

R-squared	0.170843	Mean dependent var	-0.008719
Adjusted R-squared	0.150454	S.D. dependent var	0.064407
S.E. of regression	0.059364	Akaike info criterion	-2.779021
Sum squared resid	0.429941	Schwarz criterion	-2.688980
Log likelihood	179.0783	Hannan-Quinn criter.	-2.742440
F-statistic	8.379117	Durbin-Watson stat	2.068657
Prob(F-statistic)	0.000041		

Null Hypothesis: D(LINTR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.085112	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINTR,2)
Method: Least Squares
Date: 01/23/23 Time: 23:22
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINTR(-1))	-0.694101	0.085849	-8.085112	0.0000
C	-0.005309	0.011227	-0.472883	0.6371
@TREND("1990Q1")	-1.15E-05	0.000151	-0.076063	0.9395

R-squared	0.347033	Mean dependent var	3.01E-18
Adjusted R-squared	0.336416	S.D. dependent var	0.075880
S.E. of regression	0.061812	Akaike info criterion	-2.705907
Sum squared resid	0.469954	Schwarz criterion	-2.638376
Log likelihood	173.4721	Hannan-Quinn criter.	-2.678471
F-statistic	32.68546	Durbin-Watson stat	1.999553
Prob(F-statistic)	0.000000		

Null Hypothesis: LINTR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.701931	0.2377
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003908
HAC corrected variance (Bartlett kernel)	0.005212

Phillips-Perron Test Equation
Dependent Variable: D(LINTR)
Method: Least Squares
Date: 01/23/23 Time: 23:23
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINTR(-1)	-0.086314	0.036697	-2.352063	0.0202
C	0.254913	0.112022	2.275572	0.0246
@TREND("1990Q1")	-0.000707	0.000329	-2.149178	0.0336

R-squared	0.042865	Mean dependent var	-0.008650
Adjusted R-squared	0.027428	S.D. dependent var	0.064155
S.E. of regression	0.063269	Akaike info criterion	-2.659494
Sum squared resid	0.496373	Schwarz criterion	-2.592309
Log likelihood	171.8779	Hannan-Quinn criter.	-2.632197
F-statistic	2.776664	Durbin-Watson stat	1.332591
Prob(F-statistic)	0.066120		

Null Hypothesis: D(LINTR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.877427	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003730
HAC corrected variance (Bartlett kernel)	0.003096

Phillips-Perron Test Equation
Dependent Variable: D(LINTR,2)
Method: Least Squares
Date: 01/23/23 Time: 23:23
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINTR(-1))	-0.694101	0.085849	-8.085112	0.0000
C	-0.005309	0.011227	-0.472883	0.6371
@TREND("1990Q1")	-1.15E-05	0.000151	-0.076063	0.9395

R-squared	0.347033	Mean dependent var	3.01E-18
Adjusted R-squared	0.336416	S.D. dependent var	0.075880
S.E. of regression	0.061812	Akaike info criterion	-2.705907
Sum squared resid	0.469954	Schwarz criterion	-2.638376
Log likelihood	173.4721	Hannan-Quinn criter.	-2.678471
F-statistic	32.68546	Durbin-Watson stat	1.999553
Prob(F-statistic)	0.000000		

Null Hypothesis: LINFL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.015063	0.0000
Test critical values:	1% level	-4.034997	
	5% level	-3.447072	
	10% level	-3.148578	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFL)
Method: Least Squares
Date: 01/23/23 Time: 23:26
Sample (adjusted): 1990Q2 2021Q4
Included observations: 122 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFL(-1)	-0.517639	0.086057	-6.015063	0.0000
C	1.085551	0.214608	5.058301	0.0000
@TREND("1990Q1")	-0.002998	0.001507	-1.989420	0.0489

R-squared	0.233533	Mean dependent var	-0.024981
Adjusted R-squared	0.220651	S.D. dependent var	0.640835
S.E. of regression	0.565734	Akaike info criterion	1.722897
Sum squared resid	38.08654	Schwarz criterion	1.791849
Log likelihood	-102.0967	Hannan-Quinn criter.	1.750903
F-statistic	18.12887	Durbin-Watson stat	1.831375
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LINFL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.975778	0.0000
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFL,2)
Method: Least Squares
Date: 01/23/23 Time: 23:28
Sample (adjusted): 1991Q3 2020Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFL(-1))	-2.695263	0.337931	-7.975778	0.0000
D(LINFL(-1),2)	1.365718	0.286730	4.763078	0.0000
D(LINFL(-2),2)	0.997158	0.229570	4.343596	0.0000
D(LINFL(-3),2)	0.690606	0.163490	4.224142	0.0001
D(LINFL(-4),2)	0.356216	0.098370	3.621177	0.0005
C	-0.070663	0.115227	-0.613254	0.5411
@TREND("1990Q1")	0.000707	0.001598	0.442535	0.6591

R-squared	0.632869	Mean dependent var	-0.019560
Adjusted R-squared	0.610841	S.D. dependent var	0.910155
S.E. of regression	0.567778	Akaike info criterion	1.769012
Sum squared resid	32.23724	Schwarz criterion	1.943870
Log likelihood	-87.64212	Hannan-Quinn criter.	1.839897
F-statistic	28.73034	Durbin-Watson stat	2.020318
Prob(F-statistic)	0.000000		

Null Hypothesis: LINFL has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.859720	0.0000
Test critical values:	1% level	-4.034997	
	5% level	-3.447072	
	10% level	-3.148578	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.312185
HAC corrected variance (Bartlett kernel)	0.290152

Phillips-Perron Test Equation
Dependent Variable: D(LINFL)
Method: Least Squares
Date: 01/23/23 Time: 23:29
Sample (adjusted): 1990Q2 2021Q4
Included observations: 122 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINFL(-1)	-0.517639	0.086057	-6.015063	0.0000
C	1.085551	0.214608	5.058301	0.0000
@TREND("1990Q1")	-0.002998	0.001507	-1.989420	0.0489

R-squared	0.233533	Mean dependent var	-0.024981
Adjusted R-squared	0.220651	S.D. dependent var	0.640835
S.E. of regression	0.565734	Akaike info criterion	1.722897
Sum squared resid	38.08654	Schwarz criterion	1.791849
Log likelihood	-102.0967	Hannan-Quinn criter.	1.750903
F-statistic	18.12887	Durbin-Watson stat	1.831375
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LINFL) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 43 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-31.49949	0.0001
Test critical values:	1% level	-4.036983	
	5% level	-3.448021	
	10% level	-3.149135	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.393249
HAC corrected variance (Bartlett kernel)	0.022860

Phillips-Perron Test Equation
Dependent Variable: D(LINFL,2)
Method: Least Squares
Date: 01/23/23 Time: 23:29
Sample (adjusted): 1990Q3 2021Q4
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFL(-1))	-1.212087	0.094515	-12.82422	0.0000
C	-0.050203	0.117280	-0.428066	0.6694
@TREND("1990Q1")	0.000545	0.001607	0.338960	0.7353

R-squared	0.586457	Mean dependent var	-0.003842
Adjusted R-squared	0.579327	S.D. dependent var	0.979278
S.E. of regression	0.635153	Akaike info criterion	1.954985
Sum squared resid	46.79664	Schwarz criterion	2.025047
Log likelihood	-113.3216	Hannan-Quinn criter.	1.983435
F-statistic	82.25150	Durbin-Watson stat	2.005871
Prob(F-statistic)	0.000000		

Null Hypothesis: LREER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.284705	0.0000
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREER)
Method: Least Squares
Date: 01/30/23 Time: 22:47
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREER(-1)	-0.818097	0.088112	-9.284705	0.0000
C	0.373421	0.189422	1.971367	0.0509
@TREND("1990Q1")	0.004147	0.002534	1.636433	0.1043

R-squared	0.410169	Mean dependent var	0.000426
Adjusted R-squared	0.400656	S.D. dependent var	1.335026
S.E. of regression	1.033541	Akaike info criterion	2.927197
Sum squared resid	132.4577	Schwarz criterion	2.994383
Log likelihood	-182.8770	Hannan-Quinn criter.	2.954494
F-statistic	43.11491	Durbin-Watson stat	2.011356
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LREER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.375499	0.0000
Test critical values:	1% level	-4.036310	
	5% level	-3.447699	
	10% level	-3.148946	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LREER,2)
Method: Least Squares
Date: 01/30/23 Time: 22:50
Sample (adjusted): 1992Q1 2021Q4
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREER(-1))	-3.842093	0.520927	-7.375499	0.0000
D(LREER(-1),2)	2.181456	0.478128	4.562495	0.0000
D(LREER(-2),2)	1.640515	0.408788	4.013122	0.0001
D(LREER(-3),2)	1.262520	0.335405	3.764163	0.0003
D(LREER(-4),2)	0.867087	0.259834	3.337081	0.0012
D(LREER(-5),2)	0.424289	0.176025	2.410387	0.0176
D(LREER(-6),2)	0.261274	0.091148	2.866488	0.0050
C	0.062327	0.216232	0.288239	0.7737
@TREND("1990Q1")	-0.000320	0.002850	-0.112281	0.9108

R-squared	0.797038	Mean dependent var	-0.001167
Adjusted R-squared	0.782410	S.D. dependent var	2.317422
S.E. of regression	1.080996	Akaike info criterion	3.065682
Sum squared resid	129.7094	Schwarz criterion	3.274744
Log likelihood	-174.9409	Hannan-Quinn criter.	3.150583
F-statistic	54.48764	Durbin-Watson stat	2.063802
Prob(F-statistic)	0.000000		

Null Hypothesis: LREER has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.284705	0.0000
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.042974
HAC corrected variance (Bartlett kernel)	1.042974

Phillips-Perron Test Equation
Dependent Variable: D(LREER)
Method: Least Squares
Date: 01/30/23 Time: 22:52
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LREER(-1)	-0.818097	0.088112	-9.284705	0.0000
C	0.373421	0.189422	1.971367	0.0509
@TREND("1990Q1")	0.004147	0.002534	1.636433	0.1043

R-squared	0.410169	Mean dependent var	0.000426
Adjusted R-squared	0.400656	S.D. dependent var	1.335026
S.E. of regression	1.033541	Akaike info criterion	2.927197
Sum squared resid	132.4577	Schwarz criterion	2.994383
Log likelihood	-182.8770	Hannan-Quinn criter.	2.954494
F-statistic	43.11491	Durbin-Watson stat	2.011356
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LREER) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 125 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-99.68535	0.0001
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.426290
HAC corrected variance (Bartlett kernel)	0.023908

Phillips-Perron Test Equation
Dependent Variable: D(LREER,2)
Method: Least Squares
Date: 01/30/23 Time: 22:53
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREER(-1))	-1.439559	0.080676	-17.84381	0.0000
C	0.005033	0.219237	0.022956	0.9817
@TREND("1990Q1")	6.66E-05	0.002961	0.022505	0.9821

R-squared	0.721352	Mean dependent var	0.011688
Adjusted R-squared	0.716821	S.D. dependent var	2.271464
S.E. of regression	1.208750	Akaike info criterion	3.240573
Sum squared resid	179.7125	Schwarz criterion	3.308103
Log likelihood	-201.1561	Hannan-Quinn criter.	3.268008
F-statistic	159.2083	Durbin-Watson stat	2.277158
Prob(F-statistic)	0.000000		

Null Hypothesis: LPRP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.828579	0.1900
Test critical values:	1% level	-4.033108	
	5% level	-3.446168	
	10% level	-3.148049	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPRP)
Method: Least Squares
Date: 09/13/23 Time: 17:16
Sample (adjusted): 1990Q2 2021Q4
Included observations: 125 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPRP(-1)	-0.122849	0.043431	-2.828579	0.0055
C	0.319377	0.116623	2.738543	0.0071
@TREND("1990Q1")	8.24E-05	0.000314	0.262448	0.7934

R-squared	0.061815	Mean dependent var	0.000000
Adjusted R-squared	0.046435	S.D. dependent var	0.132679
S.E. of regression	0.129562	Akaike info criterion	-1.225615
Sum squared resid	2.047915	Schwarz criterion	-1.157735
Log likelihood	79.60091	Hannan-Quinn criter.	-1.198039
F-statistic	4.019171	Durbin-Watson stat	1.901186
Prob(F-statistic)	0.020398		

Null Hypothesis: D(LPRP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.95769	0.0000
Test critical values:	1% level	-4.034356	
	5% level	-3.446765	
	10% level	-3.148399	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPRP,2)
Method: Least Squares
Date: 09/13/23 Time: 17:19
Sample (adjusted): 1990Q3 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRP(-1))	-1.000295	0.091287	-10.95769	0.0000
C	-0.004028	0.024605	-0.163700	0.8702
@TREND("1990Q1")	6.22E-05	0.000331	0.188300	0.8510

R-squared	0.500148	Mean dependent var	2.91E-18
Adjusted R-squared	0.491817	S.D. dependent var	0.189168
S.E. of regression	0.134852	Akaike info criterion	-1.145192
Sum squared resid	2.182203	Schwarz criterion	-1.076602
Log likelihood	73.42930	Hannan-Quinn criter.	-1.117331
F-statistic	60.03546	Durbin-Watson stat	2.016439
Prob(F-statistic)	0.000000		

Null Hypothesis: LPRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.853485	0.1814
Test critical values:	1% level	-4.033108	
	5% level	-3.446168	
	10% level	-3.148049	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.016383
HAC corrected variance (Bartlett kernel)	0.016707

Phillips-Perron Test Equation
Dependent Variable: D(LPRP)
Method: Least Squares
Date: 09/13/23 Time: 17:20
Sample (adjusted): 1990Q2 2021Q4
Included observations: 125 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPRP(-1)	-0.122849	0.043431	-2.828579	0.0055
C	0.319377	0.116623	2.738543	0.0071
@TREND("1990Q1")	8.24E-05	0.000314	0.262448	0.7934

R-squared	0.061815	Mean dependent var	0.000000
Adjusted R-squared	0.046435	S.D. dependent var	0.132679
S.E. of regression	0.129562	Akaike info criterion	-1.225615
Sum squared resid	2.047915	Schwarz criterion	-1.157735
Log likelihood	79.60091	Hannan-Quinn criter.	-1.198039
F-statistic	4.019171	Durbin-Watson stat	1.901186
Prob(F-statistic)	0.020398		

Null Hypothesis: D(LPRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.95726	0.0000
Test critical values:	1% level	-4.034356	
	5% level	-3.446765	
	10% level	-3.148399	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.017741
HAC corrected variance (Bartlett kernel)	0.017032

Phillips-Perron Test Equation
Dependent Variable: D(LPRP,2)
Method: Least Squares
Date: 09/13/23 Time: 17:22
Sample (adjusted): 1990Q3 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRP(-1))	-1.000295	0.091287	-10.95769	0.0000
C	-0.004028	0.024605	-0.163700	0.8702
@TREND("1990Q1")	6.22E-05	0.000331	0.188300	0.8510

R-squared	0.500148	Mean dependent var	2.91E-18
Adjusted R-squared	0.491817	S.D. dependent var	0.189168
S.E. of regression	0.134852	Akaike info criterion	-1.145192
Sum squared resid	2.182203	Schwarz criterion	-1.076602
Log likelihood	73.42930	Hannan-Quinn criter.	-1.117331
F-statistic	60.03546	Durbin-Watson stat	2.016439
Prob(F-statistic)	0.000000		

Null Hypothesis: LRWR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.028800	0.9962
Test critical values:	1% level	-4.034356	
	5% level	-3.446765	
	10% level	-3.148399	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRWR)
Method: Least Squares
Date: 01/24/23 Time: 11:18
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRWR(-1)	0.000944	0.032772	0.028800	0.9771
D(LRWR(-1))	-0.650893	0.096294	-6.759455	0.0000
D(LRWR(-2))	-0.620244	0.095661	-6.483748	0.0000
D(LRWR(-3))	-0.596546	0.095495	-6.246911	0.0000
D(LRWR(-4))	0.228676	0.088687	2.578452	0.0112
C	0.078648	0.359171	0.218969	0.8271
@TREND("1990Q1")	-0.000450	0.000786	-0.572273	0.5682

R-squared	0.752971	Mean dependent var	0.023586
Adjusted R-squared	0.740194	S.D. dependent var	0.061925
S.E. of regression	0.031564	Akaike info criterion	-4.018378
Sum squared resid	0.115569	Schwarz criterion	-3.858335
Log likelihood	254.1302	Hannan-Quinn criter.	-3.953369
F-statistic	58.93010	Durbin-Watson stat	1.997863
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LRWR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.927599	0.0000
Test critical values:	1% level	-4.034356	
	5% level	-3.446765	
	10% level	-3.148399	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRWR,2)
Method: Least Squares
Date: 01/24/23 Time: 11:20
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRWR(-1))	-2.636408	0.332561	-7.927599	0.0000
D(LRWR(-1),2)	0.986503	0.252986	3.899439	0.0002
D(LRWR(-2),2)	0.367033	0.172273	2.130527	0.0352
D(LRWR(-3),2)	-0.228946	0.087815	-2.607125	0.0103
C	0.088985	0.013015	6.836899	0.0000
@TREND("1990Q1")	-0.000427	9.82E-05	-4.347151	0.0000

R-squared	0.914515	Mean dependent var	0.000799
Adjusted R-squared	0.910862	S.D. dependent var	0.105268
S.E. of regression	0.031429	Akaike info criterion	-4.034631
Sum squared resid	0.115569	Schwarz criterion	-3.897451
Log likelihood	254.1298	Hannan-Quinn criter.	-3.978909
F-statistic	250.3316	Durbin-Watson stat	1.997912
Prob(F-statistic)	0.000000		

Null Hypothesis: LRWR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.020491	0.0103
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003487
HAC corrected variance (Bartlett kernel)	0.003631

Phillips-Perron Test Equation
Dependent Variable: D(LRWR)
Method: Least Squares
Date: 01/24/23 Time: 11:23
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRWR(-1)	-0.203401	0.051237	-3.969828	0.0001
C	2.277659	0.564638	4.033841	0.0001
@TREND("1990Q1")	0.004621	0.001220	3.786274	0.0002

R-squared	0.123566	Mean dependent var	0.024393
Adjusted R-squared	0.109430	S.D. dependent var	0.063324
S.E. of regression	0.059759	Akaike info criterion	-2.773653
Sum squared resid	0.442822	Schwarz criterion	-2.706467
Log likelihood	179.1270	Hannan-Quinn criter.	-2.746356
F-statistic	8.741186	Durbin-Watson stat	2.619209
Prob(F-statistic)	0.000281		

Null Hypothesis: D(LRWR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-38.35643	0.0001
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003051
HAC corrected variance (Bartlett kernel)	0.000410

Phillips-Perron Test Equation
Dependent Variable: D(LRWR,2)
Method: Least Squares
Date: 01/24/23 Time: 11:23
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRWR(-1))	-1.449892	0.079144	-18.31972	0.0000
C	0.049405	0.010552	4.682030	0.0000
@TREND("1990Q1")	-0.000233	0.000138	-1.691933	0.0932

R-squared	0.731870	Mean dependent var	-0.001025
Adjusted R-squared	0.727510	S.D. dependent var	0.107101
S.E. of regression	0.055907	Akaike info criterion	-2.906721
Sum squared resid	0.384452	Schwarz criterion	-2.839190
Log likelihood	186.1234	Hannan-Quinn criter.	-2.879285
F-statistic	167.8664	Durbin-Watson stat	2.268992
Prob(F-statistic)	0.000000		

Null Hypothesis: LPUBSC has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.30741	0.0000
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPUBSC)
Method: Least Squares
Date: 01/30/23 Time: 23:06
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPUBSC(-1)	-1.107015	0.089947	-12.30741	0.0000
C	8.163314	0.686096	11.89821	0.0000
@TREND("1990Q1")	0.023485	0.003364	6.980315	0.0000

R-squared	0.550126	Mean dependent var	0.015528
Adjusted R-squared	0.542870	S.D. dependent var	1.654823
S.E. of regression	1.118849	Akaike info criterion	3.085816
Sum squared resid	155.2260	Schwarz criterion	3.153001
Log likelihood	-192.9493	Hannan-Quinn criter.	3.113113
F-statistic	75.81649	Durbin-Watson stat	2.002746
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPUBSC) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.83420	0.0000
Test critical values:	1% level	-4.033727	
	5% level	-3.446464	
	10% level	-3.148223	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPUBSC,2)
Method: Least Squares
Date: 01/30/23 Time: 23:08
Sample (adjusted): 1991Q1 2021Q4
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPUBSC(-1))	-2.770128	0.234078	-11.83420	0.0000
D(LPUBSC(-1),2)	0.919983	0.172214	5.342094	0.0000
D(LPUBSC(-2),2)	0.286444	0.088601	3.232960	0.0016
C	0.049226	0.237030	0.207676	0.8358
@TREND("1990Q1")	-2.95E-05	0.003174	-0.009296	0.9926

R-squared	0.813411	Mean dependent var	-0.038576
Adjusted R-squared	0.807140	S.D. dependent var	2.880383
S.E. of regression	1.264946	Akaike info criterion	3.347422
Sum squared resid	190.4104	Schwarz criterion	3.461143
Log likelihood	-202.5402	Hannan-Quinn criter.	3.393618
F-statistic	129.6917	Durbin-Watson stat	2.078411
Prob(F-statistic)	0.000000		

Null Hypothesis: LPUBSC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.31291	0.0000
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

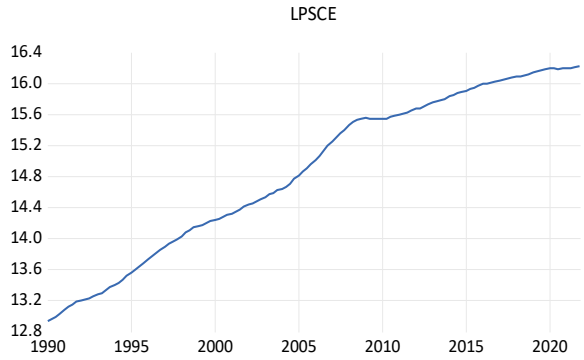
Residual variance (no correction)	1.222252
HAC corrected variance (Bartlett kernel)	1.209522

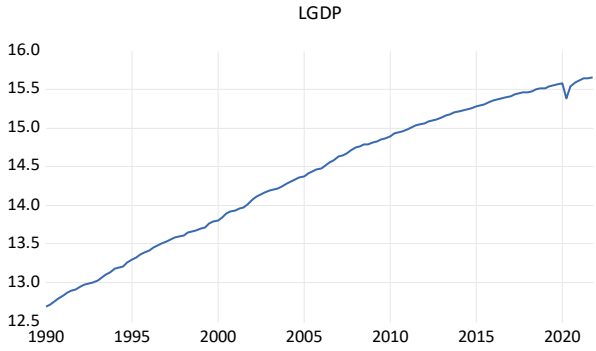
Phillips-Perron Test Equation
Dependent Variable: D(LPUBSC)
Method: Least Squares
Date: 01/30/23 Time: 23:12
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

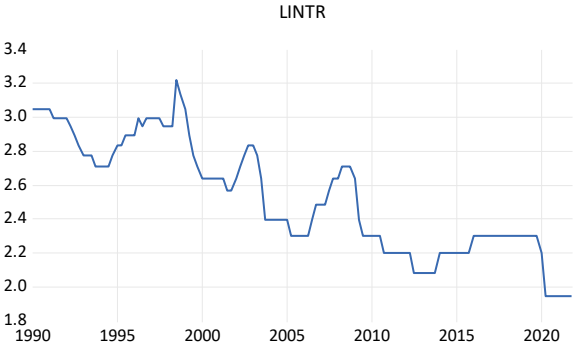
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPUBSC(-1)	-1.107015	0.089947	-12.30741	0.0000
C	8.163314	0.686096	11.89821	0.0000
@TREND("1990Q1")	0.023485	0.003364	6.980315	0.0000

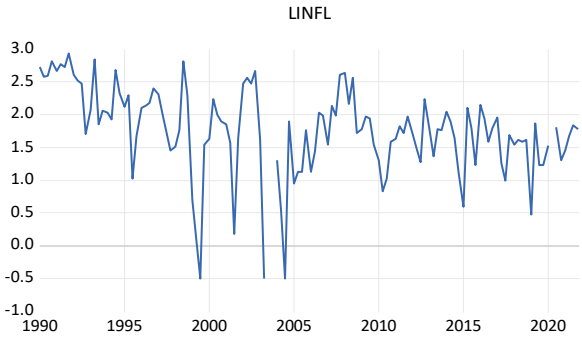
R-squared	0.550126	Mean dependent var	0.015528
Adjusted R-squared	0.542870	S.D. dependent var	1.654823
S.E. of regression	1.118849	Akaike info criterion	3.085816
Sum squared resid	155.2260	Schwarz criterion	3.153001
Log likelihood	-192.9493	Hannan-Quinn criter.	3.113113
F-statistic	75.81649	Durbin-Watson stat	2.002746
Prob(F-statistic)	0.000000		

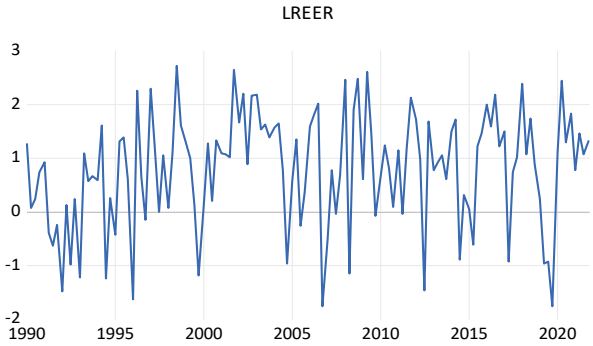
Visual inspection for both ADF & PP at level

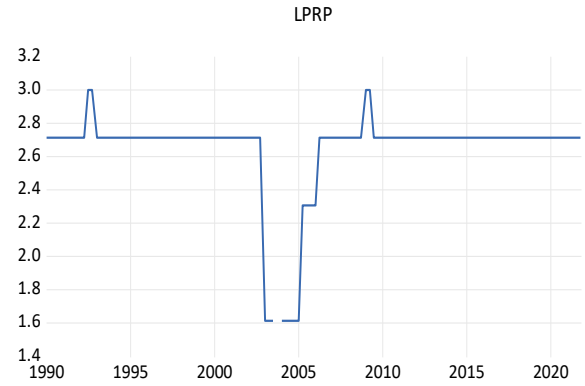


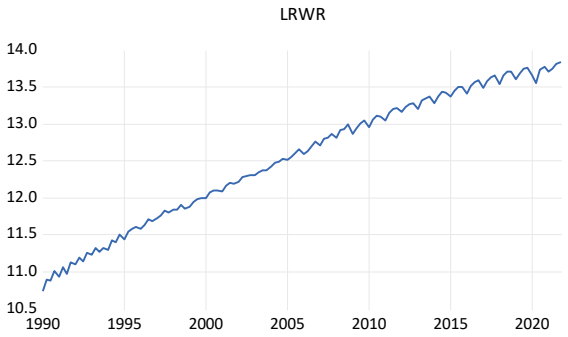


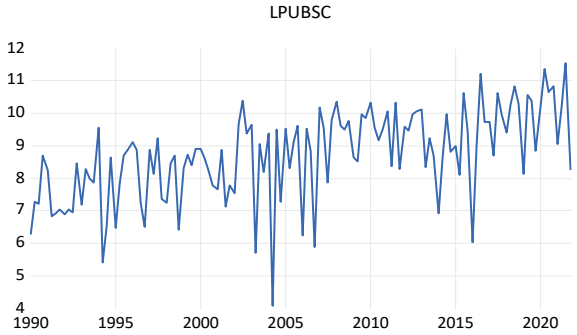




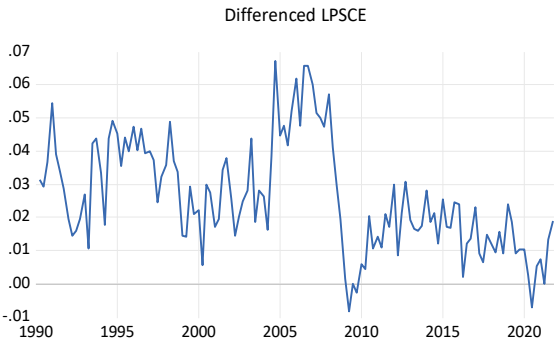


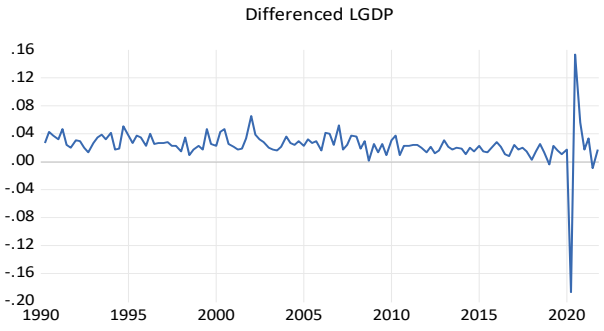


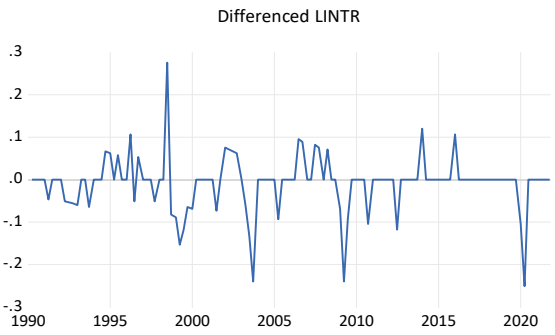


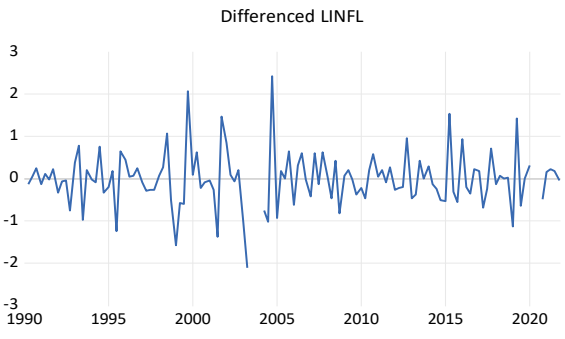


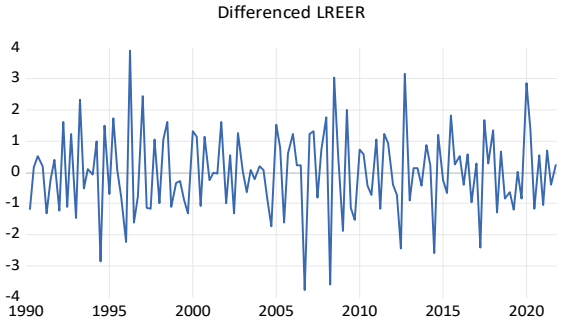
Visual inspection of both ADF & PP at first difference

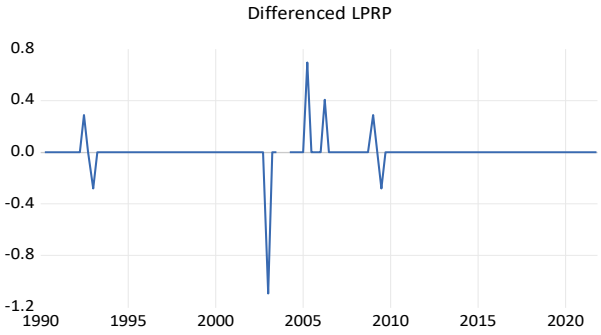


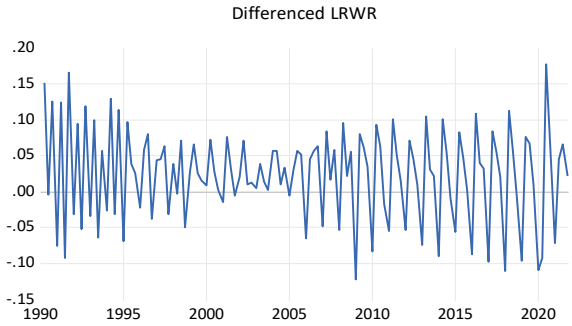


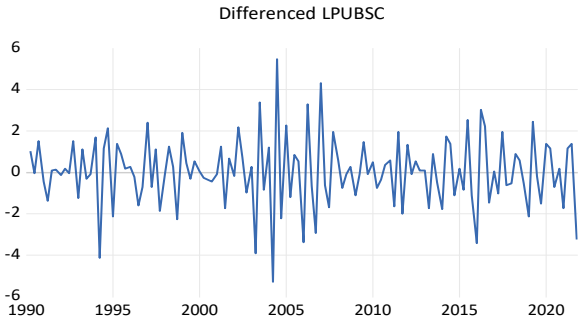












ARDL test

Dependent Variable: LPSCE1
Method: ARDL
Date: 09/13/23 Time: 20:33
Sample (adjusted): 1991Q1 2021Q4
Included observations: 124 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LGDP1 LINTR1 LINFL LREER LPRP1 LRWR1 LPUBSC
Fixed regressors: C
Number of models evaluated: 16384
Selected Model: ARDL(1, 0, 0, 0, 0, 3, 3, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LPSCE1(-1)	0.717055	0.058782	12.19853	0.0000
LGDP1	0.003684	0.036677	0.100451	0.9202
LINTR1	0.020521	0.015517	1.322498	0.1888
LINFL	-0.004075	0.001383	-2.946612	0.0039
LREER	0.000592	0.000808	0.732141	0.4657
LPRP1	-0.003137	0.003696	-0.848780	0.3979
LPRP1(-1)	-8.45E-05	0.003826	-0.022087	0.9824
LPRP1(-2)	0.014193	0.004006	3.542616	0.0006
LPRP1(-3)	0.008265	0.004012	2.060041	0.0418
LRWR1	0.028003	0.028011	0.999715	0.3197
LRWR1(-1)	0.096132	0.027516	3.493726	0.0007
LRWR1(-2)	0.054360	0.026730	2.033677	0.0445
LRWR1(-3)	0.061863	0.025702	2.406888	0.0178
LPUBSC	-0.000875	0.000682	-1.281912	0.2026
LPUBSC(-1)	0.000473	0.000701	0.674295	0.5016
LPUBSC(-2)	-0.001411	0.000706	-1.997876	0.0483
C	0.023932	0.011308	2.116314	0.0366

R-squared	0.755782	Mean dependent var	0.025882
Adjusted R-squared	0.719264	S.D. dependent var	0.016555
S.E. of regression	0.008771	Akaike info criterion	-6.507888
Sum squared resid	0.008232	Schwarz criterion	-6.121237
Log likelihood	420.4891	Hannan-Quinn criter.	-6.350821
F-statistic	20.69585	Durbin-Watson stat	2.191546
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Long run form and Bounds test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LPSCE1)
Selected Model: ARDL(1, 0, 0, 0, 0, 3, 3, 2)
Case 2: Restricted Constant and No Trend
Date: 09/13/23 Time: 20:34
Sample: 1990Q1 2021Q4
Included observations: 124

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023932	0.011308	2.116314	0.0366
LPSCE1(-1)*	-0.282945	0.058782	-4.813445	0.0000
LGDP1**	0.003684	0.036677	0.100451	0.9202
LINTR1**	0.020521	0.015517	1.322498	0.1888
LINFL**	-0.004075	0.001383	-2.946612	0.0039
LREER**	0.000592	0.000808	0.732141	0.4657
LPRP1(-1)	0.019237	0.009804	1.962268	0.0523
LRWR1(-1)	0.240358	0.099559	2.414220	0.0175
LPUBSC(-1)	-0.001812	0.001050	-1.725247	0.0874
D(LPRP1)	-0.003137	0.003696	-0.848780	0.3979
D(LPRP1(-1))	-0.022459	0.006650	-3.377393	0.0010
D(LPRP1(-2))	-0.008265	0.004012	-2.060041	0.0418
D(LRWR1)	0.028003	0.028011	0.999715	0.3197
D(LRWR1(-1))	-0.116222	0.050043	-2.322431	0.0221
D(LRWR1(-2))	-0.061863	0.025702	-2.406888	0.0178
D(LPUBSC)	-0.000875	0.000682	-1.281912	0.2026
D(LPUBSC(-1))	0.001411	0.000706	1.997876	0.0483

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP1	0.013021	0.129619	0.100456	0.9202
LINTR1	0.072526	0.052953	1.369613	0.1737
LINFL	-0.014403	0.005790	-2.487630	0.0144
LREER	0.002092	0.002909	0.719219	0.4736
LPRP1	0.067990	0.036701	1.852534	0.0667
LRWR1	0.849487	0.388464	2.186785	0.0309
LPUBSC	-0.006405	0.003412	-1.877122	0.0632
C	0.084582	0.035689	2.369957	0.0196

EC = LPSCE1 - (0.0130*LGDP1 + 0.0725*LINTR1 -0.0144*LINFL + 0.0021
*LREER + 0.0680*LPRP1 + 0.8495*LRWR1 -0.0064*LPUBSC + 0.0846)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	4.272718	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
Actual Sample Size	124	Finite Sample: n=80		
		10%	2.017	3.052
		5%	2.336	3.458
		1%	3.021	4.35

ARDL ECM Version

ARDL Error Correction Regression
Dependent Variable: D(LPSCE1)
Selected Model: ARDL(1, 0, 0, 0, 0, 3, 3, 2)
Case 2: Restricted Constant and No Trend
Date: 09/13/23 Time: 20:35
Sample: 1990Q1 2021Q4
Included observations: 124

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRP1)	-0.003137	0.003105	-1.010172	0.3147
D(LPRP1(-1))	-0.022459	0.004387	-5.119057	0.0000
D(LPRP1(-2))	-0.008265	0.003382	-2.443621	0.0162
D(LRWR1)	0.028003	0.013469	2.079105	0.0400
D(LRWR1(-1))	-0.116222	0.023698	-4.904327	0.0000
D(LRWR1(-2))	-0.061863	0.013480	-4.589315	0.0000
D(LPUBSC)	-0.000875	0.000571	-1.532110	0.1284
D(LPUBSC(-1))	0.001411	0.000573	2.462618	0.0154
CointEq(-1)*	-0.282945	0.044012	-6.428807	0.0000

R-squared	0.461878	Mean dependent var	-0.000143
Adjusted R-squared	0.424443	S.D. dependent var	0.011152
S.E. of regression	0.008461	Akaike info criterion	-6.636921
Sum squared resid	0.008232	Schwarz criterion	-6.432223
Log likelihood	420.4891	Hannan-Quinn criter.	-6.553768
Durbin-Watson stat	2.191546		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.272718	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9

Diagnostic Tests

Heteroscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.193141	Prob. F(16,107)	0.2854
Obs*R-squared	18.77379	Prob. Chi-Square(16)	0.2806
Scaled explained SS	14.51093	Prob. Chi-Square(16)	0.5607

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/13/23 Time: 20:36
Sample: 1991Q1 2021Q4
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000244	0.000122	1.998413	0.0482
LPSCE1(-1)	-0.000495	0.000636	-0.778158	0.4382
LGDP1	0.000307	0.000397	0.773447	0.4410
LINTR1	-7.24E-05	0.000168	-0.431569	0.6669
LINFL	2.91E-05	1.50E-05	1.944860	0.0544
LREER	-9.52E-06	8.74E-06	-1.089305	0.2785
LPRP1	2.68E-05	4.00E-05	0.669874	0.5044
LPRP1(-1)	-1.29E-05	4.14E-05	-0.312398	0.7553
LPRP1(-2)	-2.89E-05	4.33E-05	-0.667909	0.5056
LPRP1(-3)	-2.58E-05	4.34E-05	-0.595624	0.5527
LRWR1	-0.000347	0.000303	-1.145375	0.2546
LRWR1(-1)	-8.56E-05	0.000298	-0.287740	0.7741
LRWR1(-2)	-0.000274	0.000289	-0.947995	0.3453
LRWR1(-3)	-2.93E-05	0.000278	-0.105427	0.9162
LPUBSC	-5.03E-06	7.38E-06	-0.682009	0.4967
LPUBSC(-1)	-6.97E-06	7.58E-06	-0.918347	0.3605
LPUBSC(-2)	-1.06E-05	7.64E-06	-1.388316	0.1679

R-squared	0.151402	Mean dependent var	6.64E-05
Adjusted R-squared	0.024508	S.D. dependent var	9.60E-05
S.E. of regression	9.49E-05	Akaike info criterion	-15.56152
Sum squared resid	9.63E-07	Schwarz criterion	-15.17487
Log likelihood	981.8145	Hannan-Quinn criter.	-15.40446
F-statistic	1.193141	Durbin-Watson stat	1.687237
Prob(F-statistic)	0.285366		

Heteroskedasticity Test: Harvey
Null hypothesis: Homoskedasticity

F-statistic	1.006778	Prob. F(16,107)	0.4556
Obs*R-squared	16.22511	Prob. Chi-Square(16)	0.4374
Scaled explained SS	23.82230	Prob. Chi-Square(16)	0.0935

Test Equation:
Dependent Variable: LRESID2
Method: Least Squares
Date: 09/13/23 Time: 20:37
Sample: 1991Q1 2021Q4
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.968046	3.482795	-1.426454	0.1566
LPSCE1(-1)	-24.19616	18.10396	-1.336512	0.1842
LGDP1	-8.363866	11.29589	-0.740434	0.4607
LINTR1	2.959793	4.778875	0.619349	0.5370
LINFL	0.212592	0.425943	0.499108	0.6187
LREER	-0.092709	0.248982	-0.372352	0.7104
LPRP1	0.012442	1.138221	0.010931	0.9913
LPRP1(-1)	-2.490703	1.178256	-2.113890	0.0368
LPRP1(-2)	-0.035711	1.233927	-0.028941	0.9770
LPRP1(-3)	0.401826	1.235703	0.325180	0.7457
LRWR1	-4.846769	8.626961	-0.561816	0.5754
LRWR1(-1)	3.295357	8.474384	0.388861	0.6982
LRWR1(-2)	-3.131598	8.232320	-0.380403	0.7044
LRWR1(-3)	-1.326446	7.915949	-0.167566	0.8672
LPUBSC	-0.151923	0.210103	-0.723086	0.4712
LPUBSC(-1)	-0.284561	0.215999	-1.317420	0.1905
LPUBSC(-2)	-0.207653	0.217477	-0.954827	0.3418

R-squared	0.130848	Mean dependent var	-11.30270
Adjusted R-squared	0.000881	S.D. dependent var	2.702659
S.E. of regression	2.701468	Akaike info criterion	4.952209
Sum squared resid	780.8785	Schwarz criterion	5.338860
Log likelihood	-290.0369	Hannan-Quinn criter.	5.109276
F-statistic	1.006778	Durbin-Watson stat	1.815645
Prob(F-statistic)	0.455574		

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

F-statistic	0.952981	Prob. F(16,107)	0.5126
Obs*R-squared	15.46626	Prob. Chi-Square(16)	0.4908
Scaled explained SS	14.98129	Prob. Chi-Square(16)	0.5260

Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Date: 09/13/23 Time: 20:37
Sample: 1991Q1 2021Q4
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014980	0.006757	2.216918	0.0287
LPSCE1(-1)	-0.021626	0.035124	-0.615726	0.5394
LGDP1	0.006425	0.021915	0.293179	0.7700
LINTR1	-0.002949	0.009272	-0.318057	0.7511
LINFL	0.001215	0.000826	1.470047	0.1445
LREER	-0.000436	0.000483	-0.902200	0.3690
LPRP1	0.000789	0.002208	0.357495	0.7214
LPRP1(-1)	-0.002234	0.002286	-0.977336	0.3306
LPRP1(-2)	-0.001234	0.002394	-0.515513	0.6073
LPRP1(-3)	-9.98E-05	0.002397	-0.041609	0.9669
LRWR1	-0.011383	0.016737	-0.680081	0.4979
LRWR1(-1)	0.002165	0.016441	0.131708	0.8955
LRWR1(-2)	-0.007557	0.015972	-0.473182	0.6370
LRWR1(-3)	0.002842	0.015358	0.185043	0.8535
LPUBSC	-0.000181	0.000408	-0.444342	0.6577
LPUBSC(-1)	-0.000410	0.000419	-0.977979	0.3303
LPUBSC(-2)	-0.000520	0.000422	-1.233442	0.2201

R-squared	0.124728	Mean dependent var	0.006270
Adjusted R-squared	-0.006154	S.D. dependent var	0.005225
S.E. of regression	0.005241	Akaike info criterion	-7.537820
Sum squared resid	0.002939	Schwarz criterion	-7.151169
Log likelihood	484.3449	Hannan-Quinn criter.	-7.380753
F-statistic	0.952981	Durbin-Watson stat	1.699724
Prob(F-statistic)	0.512625		

Heteroskedasticity Test: ARCH

F-statistic	2.963527	Prob. F(1,121)	0.0877
Obs*R-squared	2.940493	Prob. Chi-Square(1)	0.0864

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/13/23 Time: 20:38
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.60E-05	1.05E-05	5.322732	0.0000
RESID^2(-1)	0.154835	0.089943	1.721490	0.0877

R-squared	0.023906	Mean dependent var	6.63E-05
Adjusted R-squared	0.015840	S.D. dependent var	9.64E-05
S.E. of regression	9.57E-05	Akaike info criterion	-15.65519
Sum squared resid	1.11E-06	Schwarz criterion	-15.60947
Log likelihood	964.7943	Hannan-Quinn criter.	-15.63662
F-statistic	2.963527	Durbin-Watson stat	1.973869
Prob(F-statistic)	0.087718		

Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	2.427867	Prob. F(2,105)	0.0932
Obs*R-squared	5.480924	Prob. Chi-Square(2)	0.0645

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 09/13/23 Time: 20:38
Sample: 1991Q1 2021Q4
Included observations: 124
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE1(-1)	0.116795	0.078683	1.484378	0.1407
LGDP1	0.004791	0.036266	0.132111	0.8951
LINTR1	0.009000	0.015909	0.565727	0.5728
LINFL	-5.03E-05	0.001365	-0.036867	0.9707
LREER	-0.000140	0.000802	-0.174296	0.8620
LPRP1	-0.001526	0.003713	-0.410954	0.6819
LPRP1(-1)	-0.001079	0.003807	-0.283501	0.7774
LPRP1(-2)	-0.000847	0.003974	-0.213046	0.8317
LPRP1(-3)	-0.001414	0.004017	-0.352011	0.7255
LRWR1	-0.014971	0.028485	-0.525576	0.6003
LRWR1(-1)	-0.013206	0.027832	-0.474494	0.6361
LRWR1(-2)	-0.018311	0.027671	-0.661744	0.5096
LRWR1(-3)	-0.015195	0.026296	-0.577845	0.5646
LPUBSC	8.36E-05	0.000675	0.123957	0.9016
LPUBSC(-1)	0.000237	0.000702	0.337027	0.7368
LPUBSC(-2)	8.85E-05	0.000698	0.126772	0.8994
C	-0.005040	0.011401	-0.442044	0.6594
RESID(-1)	-0.263697	0.134150	-1.965693	0.0520
RESID(-2)	-0.200834	0.114812	-1.749237	0.0832

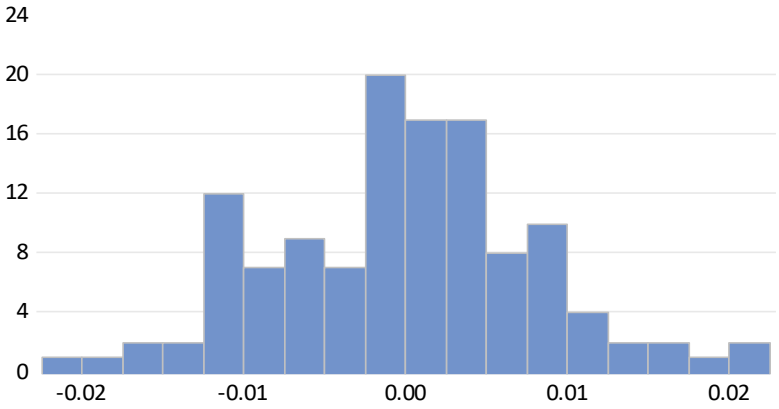
R-squared	0.044201	Mean dependent var	-1.09E-18
Adjusted R-squared	-0.119650	S.D. dependent var	0.008181
S.E. of regression	0.008657	Akaike info criterion	-6.520838
Sum squared resid	0.007869	Schwarz criterion	-6.088698
Log likelihood	423.2920	Hannan-Quinn criter.	-6.345293
F-statistic	0.269763	Durbin-Watson stat	2.054117
Prob(F-statistic)	0.998693		

Multicolinearity

Variance Inflation Factors
Date: 09/13/23 Time: 20:39
Sample: 1990Q1 2021Q4
Included observations: 124

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LPSCE1(-1)	0.003455	5.288416	1.516703
LGDP1	0.001345	2.504149	1.350011
LINTR1	0.000241	1.652620	1.622161
LINFL	1.91E-06	10.28844	1.457117
LREER	6.54E-07	1.852382	1.192713
LPRP1	1.37E-05	1.307174	1.307174
LPRP1(-1)	1.46E-05	1.400747	1.400747
LPRP1(-2)	1.61E-05	1.536241	1.536241
LPRP1(-3)	1.61E-05	1.540666	1.540666
LRWR1	0.000785	5.527821	4.871500
LRWR1(-1)	0.000757	5.485133	4.804466
LRWR1(-2)	0.000714	5.136558	4.524471
LRWR1(-3)	0.000661	4.928875	4.319918
LPUBSC	4.65E-07	58.90954	1.382300
LPUBSC(-1)	4.92E-07	62.31045	1.459339
LPUBSC(-2)	4.99E-07	62.63969	1.444273
C	0.000128	206.0999	NA

Normality test



Series: Residuals	
Sample 1991Q1 2021Q4	
Observations 124	
Mean	-1.09e-18
Median	0.000117
Maximum	0.021763
Minimum	-0.020025
Std. Dev.	0.008181
Skewness	0.112530
Kurtosis	3.076103
Jarque-Bera	0.291628
Probability	0.864319

Specification test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LPSCE1 LPSCE1(-1) LGDP1 LINTR1 LINFL LREER LPRP1 LPRP1(-1) LPRP1(-2) LPRP1(-3) LRWR1 LRWR1(-1) LRWR1(-2) LRWR1(-3) LPUBSC LPUBSC(-1) LPUBSC(-2) C

	Value	df	Probability
t-statistic	1.189073	106	0.2371
F-statistic	1.413894	(1, 106)	0.2371
Likelihood ratio	1.643055	1	0.1999

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000108	1	0.000108
Restricted SSR	0.008232	107	7.69E-05
Unrestricted SSR	0.008124	106	7.66E-05

LR test summary:

	Value
Restricted LogL	420.4891
Unrestricted LogL	421.3106

Unrestricted Test Equation:
Dependent Variable: LPSCE1
Method: Least Squares
Date: 09/13/23 Time: 20:40
Sample: 1991Q1 2021Q4
Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE1(-1)	0.538558	0.161173	3.341498	0.0012
LGDP1	-0.004050	0.037179	-0.108931	0.9135
LINTR1	0.018547	0.015575	1.190762	0.2364
LINFL	-0.003023	0.001639	-1.844025	0.0680
LREER	0.000469	0.000813	0.576626	0.5654
LPRP1	-0.002429	0.003736	-0.650204	0.5170
LPRP1(-1)	-0.001147	0.003922	-0.292524	0.7705
LPRP1(-2)	0.009384	0.005687	1.649998	0.1019
LPRP1(-3)	0.004391	0.005163	0.850522	0.3970
LRWR1	0.025717	0.028023	0.917713	0.3609
LRWR1(-1)	0.080829	0.030329	2.665116	0.0089
LRWR1(-2)	0.049617	0.026975	1.839401	0.0687
LRWR1(-3)	0.051806	0.027011	1.917931	0.0578
LPUBSC	-0.000766	0.000687	-1.114463	0.2676
LPUBSC(-1)	0.000267	0.000721	0.369986	0.7121
LPUBSC(-2)	-0.001141	0.000740	-1.541797	0.1261
C	0.022691	0.011335	2.001913	0.0478
FITTED^2	4.145662	3.486467	1.189073	0.2371

R-squared	0.758997	Mean dependent var	0.025882
Adjusted R-squared	0.720345	S.D. dependent var	0.016555
S.E. of regression	0.008755	Akaike info criterion	-6.505010
Sum squared resid	0.008124	Schwarz criterion	-6.095614
Log likelihood	421.3106	Hannan-Quinn criter.	-6.338704
F-statistic	19.63696	Durbin-Watson stat	2.203591
Prob(F-statistic)	0.000000		

Appendix 8.6 Supply side e-views empirical results

Unit root tests

Null Hypothesis: LPSCE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.329715	0.9890
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPSCE)
Method: Least Squares
Date: 01/24/23 Time: 14:24
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE(-1)	-0.001982	0.006012	-0.329715	0.7422
D(LPSCE(-1))	0.710213	0.066920	10.61292	0.0000
C	0.037455	0.077854	0.481086	0.6313
@TREND("1990Q1")	-8.21E-06	0.000174	-0.047139	0.9625

R-squared	0.613698	Mean dependent var	0.025993
Adjusted R-squared	0.604199	S.D. dependent var	0.016452
S.E. of regression	0.010350	Akaike info criterion	-6.272382
Sum squared resid	0.013070	Schwarz criterion	-6.182341
Log likelihood	399.1601	Hannan-Quinn criter.	-6.235801
F-statistic	64.60513	Durbin-Watson stat	2.202599
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPSCE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.627501	0.0014
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPSCE,2)
Method: Least Squares
Date: 01/24/23 Time: 14:27
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPSCE(-1))	-0.296012	0.063968	-4.627501	0.0000
C	0.011806	0.003173	3.721380	0.0003
@TREND("1990Q1")	-6.48E-05	2.88E-05	-2.250331	0.0262

R-squared	0.148285	Mean dependent var	-9.85E-05
Adjusted R-squared	0.134436	S.D. dependent var	0.011085
S.E. of regression	0.010313	Akaike info criterion	-6.287364
Sum squared resid	0.013081	Schwarz criterion	-6.219834
Log likelihood	399.1039	Hannan-Quinn criter.	-6.259929
F-statistic	10.70729	Durbin-Watson stat	2.190451
Prob(F-statistic)	0.000052		

Null Hypothesis: LPSCE has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.118869	0.9972
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000198
HAC corrected variance (Bartlett kernel)	0.000921

Phillips-Perron Test Equation
Dependent Variable: D(LPSCE)
Method: Least Squares
Date: 01/24/23 Time: 14:30
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE(-1)	0.016314	0.007903	2.064119	0.0411
C	-0.173310	0.103248	-1.678585	0.0958
@TREND("1990Q1")	-0.000670	0.000224	-2.997356	0.0033

R-squared	0.256734	Mean dependent var	0.026035
Adjusted R-squared	0.244746	S.D. dependent var	0.016393
S.E. of regression	0.014246	Akaike info criterion	-5.641276
Sum squared resid	0.025167	Schwarz criterion	-5.574090
Log likelihood	361.2210	Hannan-Quinn criter.	-5.613979
F-statistic	21.41565	Durbin-Watson stat	0.620668
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPSCE) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.747201	0.0009
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000104
HAC corrected variance (Bartlett kernel)	0.000111

Phillips-Perron Test Equation
Dependent Variable: D(LPSCE,2)
Method: Least Squares
Date: 01/24/23 Time: 14:30
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPSCE(-1))	-0.296012	0.063968	-4.627501	0.0000
C	0.011806	0.003173	3.721380	0.0003
@TREND("1990Q1")	-6.48E-05	2.88E-05	-2.250331	0.0262

R-squared	0.148285	Mean dependent var	-9.85E-05
Adjusted R-squared	0.134436	S.D. dependent var	0.011085
S.E. of regression	0.010313	Akaike info criterion	-6.287364
Sum squared resid	0.013081	Schwarz criterion	-6.219834
Log likelihood	399.1039	Hannan-Quinn criter.	-6.259929
F-statistic	10.70729	Durbin-Watson stat	2.190451
Prob(F-statistic)	0.000052		

Null Hypothesis: LGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.113242	0.9942
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 02/01/23 Time: 22:10
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.002351	0.020757	-0.113242	0.9100
D(LGDP(-1))	-0.296344	0.087805	-3.375030	0.0010
C	0.073647	0.265844	0.277030	0.7822
@TREND("1990Q1")	-0.000148	0.000505	-0.293660	0.7695

R-squared	0.138120	Mean dependent var	0.023332
Adjusted R-squared	0.116926	S.D. dependent var	0.024940
S.E. of regression	0.023437	Akaike info criterion	-4.637797
Sum squared resid	0.067012	Schwarz criterion	-4.547757
Log likelihood	296.1812	Hannan-Quinn criter.	-4.601217
F-statistic	6.517017	Durbin-Watson stat	2.110888
Prob(F-statistic)	0.000399		

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.75898	0.0000
Test critical values:	1% level	-4.033108	
	5% level	-3.446168	
	10% level	-3.148049	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 02/01/23 Time: 22:12
Sample (adjusted): 1990Q4 2021Q4
Included observations: 125 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.548970	0.143970	-10.75898	0.0000
D(LGDP(-1),2)	0.193847	0.089491	2.166102	0.0323
C	0.051707	0.006432	8.038675	0.0000
@TREND("1990Q1")	-0.000240	6.13E-05	-3.919522	0.0001

R-squared	0.662074	Mean dependent var	-0.000207
Adjusted R-squared	0.653696	S.D. dependent var	0.039226
S.E. of regression	0.023084	Akaike info criterion	-4.667895
Sum squared resid	0.064476	Schwarz criterion	-4.577389
Log likelihood	295.7435	Hannan-Quinn criter.	-4.631127
F-statistic	79.02229	Durbin-Watson stat	2.032446
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 38 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.032861	0.9963
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000578
HAC corrected variance (Bartlett kernel)	0.000281

Phillips-Perron Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 02/01/23 Time: 22:15
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.013697	0.020983	-0.652790	0.5151
C	0.208984	0.269142	0.776484	0.4389
@TREND("1990Q1")	0.000175	0.000510	0.342866	0.7323

R-squared	0.056450	Mean dependent var	0.023350
Adjusted R-squared	0.041232	S.D. dependent var	0.024842
S.E. of regression	0.024324	Akaike info criterion	-4.571346
Sum squared resid	0.073367	Schwarz criterion	-4.504161
Log likelihood	293.2805	Hannan-Quinn criter.	-4.544049
F-statistic	3.709306	Durbin-Watson stat	2.568808
Prob(F-statistic)	0.027253		

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 27 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.56902	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000532
HAC corrected variance (Bartlett kernel)	0.000220

Phillips-Perron Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 02/01/23 Time: 22:16
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.298127	0.086034	-15.08856	0.0000
C	0.043548	0.005122	8.501939	0.0000
@TREND("1990Q1")	-0.000205	5.87E-05	-3.493817	0.0007

R-squared	0.649239	Mean dependent var	-7.68E-05
Adjusted R-squared	0.643535	S.D. dependent var	0.039097
S.E. of regression	0.023342	Akaike info criterion	-4.653565
Sum squared resid	0.067019	Schwarz criterion	-4.586035
Log likelihood	296.1746	Hannan-Quinn criter.	-4.626130
F-statistic	113.8329	Durbin-Watson stat	2.112479
Prob(F-statistic)	0.000000		

Null Hypothesis: LPRP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.388879	0.0576
Test critical values:	1% level	-4.034997	
	5% level	-3.447072	
	10% level	-3.148578	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPRP)
Method: Least Squares
Date: 09/13/23 Time: 17:35
Sample (adjusted): 1991Q3 2021Q4
Included observations: 122 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPRP(-1)	-0.215866	0.063698	-3.388879	0.0010
D(LPRP(-1))	0.139723	0.097306	1.435921	0.1538
D(LPRP(-2))	0.087141	0.074474	1.170094	0.2444
D(LPRP(-3))	0.001098	0.073328	0.014978	0.9881
D(LPRP(-4))	-0.556138	0.072899	-7.628920	0.0000
D(LPRP(-5))	0.096035	0.089484	1.073205	0.2854
C	1.078357	0.267153	4.036481	0.0001
@TREND("1990Q1")	0.007879	0.003215	2.450684	0.0158

R-squared	0.494316	Mean dependent var	0.058270
Adjusted R-squared	0.463265	S.D. dependent var	0.674922
S.E. of regression	0.494462	Akaike info criterion	1.492633
Sum squared resid	27.87219	Schwarz criterion	1.676503
Log likelihood	-83.05060	Hannan-Quinn criter.	1.567315
F-statistic	15.91962	Durbin-Watson stat	2.032265
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LPRP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.92476	0.0000
Test critical values:	1% level	-4.034356	
	5% level	-3.446765	
	10% level	-3.148399	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPRP,2)
Method: Least Squares
Date: 09/13/23 Time: 17:35
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRP(-1))	-1.803191	0.139514	-12.92476	0.0000
D(LPRP(-1),2)	0.772438	0.116564	6.626733	0.0000
D(LPRP(-2),2)	0.748947	0.095948	7.805752	0.0000
D(LPRP(-3),2)	0.648532	0.070283	9.227418	0.0000
C	0.230666	0.099711	2.313350	0.0224
@TREND("1990Q1")	-0.001977	0.001318	-1.500013	0.1363

R-squared	0.698892	Mean dependent var	-0.000746
Adjusted R-squared	0.686025	S.D. dependent var	0.919800
S.E. of regression	0.515396	Akaike info criterion	1.559788
Sum squared resid	31.07907	Schwarz criterion	1.696968
Log likelihood	-89.92698	Hannan-Quinn criter.	1.615510
F-statistic	54.31308	Durbin-Watson stat	1.920543
Prob(F-statistic)	0.000000		

Null Hypothesis: LPRP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 126 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.788286	0.2044
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.384049
HAC corrected variance (Bartlett kernel)	0.074727

Phillips-Perron Test Equation
Dependent Variable: D(LPRP)
Method: Least Squares
Date: 09/13/23 Time: 17:36
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPRP(-1)	-0.220362	0.054977	-4.008282	0.0001
C	0.963865	0.239388	4.026375	0.0001
@TREND("1990Q1")	0.009527	0.003026	3.148488	0.0021

R-squared	0.117252	Mean dependent var	0.053997
Adjusted R-squared	0.103014	S.D. dependent var	0.662203
S.E. of regression	0.627169	Akaike info criterion	1.928136
Sum squared resid	48.77421	Schwarz criterion	1.995321
Log likelihood	-119.4366	Hannan-Quinn criter.	1.955432
F-statistic	8.235181	Durbin-Watson stat	1.705219
Prob(F-statistic)	0.000438		

Null Hypothesis: D(LPRP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 28 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.65165	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.435100
HAC corrected variance (Bartlett kernel)	0.054131

Phillips-Perron Test Equation
Dependent Variable: D(LPRP,2)
Method: Least Squares
Date: 09/13/23 Time: 17:37
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRP(-1))	-0.937487	0.089946	-10.42280	0.0000
C	0.115982	0.121544	0.954244	0.3418
@TREND("1990Q1")	-0.000992	0.001638	-0.606031	0.5456

R-squared	0.468997	Mean dependent var	0.001141
Adjusted R-squared	0.460363	S.D. dependent var	0.908817
S.E. of regression	0.667617	Akaike info criterion	2.053317
Sum squared resid	54.82262	Schwarz criterion	2.120848
Log likelihood	-126.3590	Hannan-Quinn criter.	2.080753
F-statistic	54.31850	Durbin-Watson stat	1.997850
Prob(F-statistic)	0.000000		

Null Hypothesis: LINTR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.369590	0.0602
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINTR)
Method: Least Squares
Date: 01/24/23 Time: 14:46
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINTR(-1)	-0.118717	0.035232	-3.369590	0.0010
D(LINTR(-1))	0.366061	0.084360	4.339263	0.0000
C	0.355601	0.107649	3.303326	0.0013
@TREND("1990Q1")	-0.000951	0.000314	-3.024119	0.0030

R-squared	0.170843	Mean dependent var	-0.008719
Adjusted R-squared	0.150454	S.D. dependent var	0.064407
S.E. of regression	0.059364	Akaike info criterion	-2.779021
Sum squared resid	0.429941	Schwarz criterion	-2.688980
Log likelihood	179.0783	Hannan-Quinn criter.	-2.742440
F-statistic	8.379117	Durbin-Watson stat	2.068657
Prob(F-statistic)	0.000041		

Null Hypothesis: D(LINTR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.085112	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINTR,2)
Method: Least Squares
Date: 01/24/23 Time: 14:48
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINTR(-1))	-0.694101	0.085849	-8.085112	0.0000
C	-0.005309	0.011227	-0.472883	0.6371
@TREND("1990Q1")	-1.15E-05	0.000151	-0.076063	0.9395

R-squared	0.347033	Mean dependent var	3.01E-18
Adjusted R-squared	0.336416	S.D. dependent var	0.075880
S.E. of regression	0.061812	Akaike info criterion	-2.705907
Sum squared resid	0.469954	Schwarz criterion	-2.638376
Log likelihood	173.4721	Hannan-Quinn criter.	-2.678471
F-statistic	32.68546	Durbin-Watson stat	1.999553
Prob(F-statistic)	0.000000		

Null Hypothesis: LINTR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.701931	0.2377
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003908
HAC corrected variance (Bartlett kernel)	0.005212

Phillips-Perron Test Equation
Dependent Variable: D(LINTR)
Method: Least Squares
Date: 01/24/23 Time: 14:50
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINTR(-1)	-0.086314	0.036697	-2.352063	0.0202
C	0.254913	0.112022	2.275572	0.0246
@TREND("1990Q1")	-0.000707	0.000329	-2.149178	0.0336

R-squared	0.042865	Mean dependent var	-0.008650
Adjusted R-squared	0.027428	S.D. dependent var	0.064155
S.E. of regression	0.063269	Akaike info criterion	-2.659494
Sum squared resid	0.496373	Schwarz criterion	-2.592309
Log likelihood	171.8779	Hannan-Quinn criter.	-2.632197
F-statistic	2.776664	Durbin-Watson stat	1.332591
Prob(F-statistic)	0.066120		

Null Hypothesis: D(LINTR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.877427	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.003730
HAC corrected variance (Bartlett kernel)	0.003096

Phillips-Perron Test Equation
Dependent Variable: D(LINTR,2)
Method: Least Squares
Date: 01/24/23 Time: 14:51
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINTR(-1))	-0.694101	0.085849	-8.085112	0.0000
C	-0.005309	0.011227	-0.472883	0.6371
@TREND("1990Q1")	-1.15E-05	0.000151	-0.076063	0.9395

R-squared	0.347033	Mean dependent var	3.01E-18
Adjusted R-squared	0.336416	S.D. dependent var	0.075880
S.E. of regression	0.061812	Akaike info criterion	-2.705907
Sum squared resid	0.469954	Schwarz criterion	-2.638376
Log likelihood	173.4721	Hannan-Quinn criter.	-2.678471
F-statistic	32.68546	Durbin-Watson stat	1.999553
Prob(F-statistic)	0.000000		

Null Hypothesis: LBD has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.116590	0.9941
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBD)
Method: Least Squares
Date: 01/24/23 Time: 14:54
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LBD(-1)	-0.001102	0.009448	-0.116590	0.9074
D(LBD(-1))	0.495944	0.080865	6.132983	0.0000
C	0.032628	0.124723	0.261600	0.7941
@TREND("1990Q1")	-3.93E-05	0.000279	-0.140969	0.8881

R-squared	0.309670	Mean dependent var	0.026758
Adjusted R-squared	0.292695	S.D. dependent var	0.018025
S.E. of regression	0.015159	Akaike info criterion	-5.509186
Sum squared resid	0.028036	Schwarz criterion	-5.419145
Log likelihood	351.0787	Hannan-Quinn criter.	-5.472605
F-statistic	18.24235	Durbin-Watson stat	2.163572
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBD) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.452475	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBD,2)
Method: Least Squares
Date: 01/24/23 Time: 14:55
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBD(-1))	-0.506191	0.078449	-6.452475	0.0000
C	0.018094	0.003967	4.561311	0.0000
@TREND("1990Q1")	-7.15E-05	3.88E-05	-1.842233	0.0678

R-squared	0.252960	Mean dependent var	-0.000128
Adjusted R-squared	0.240813	S.D. dependent var	0.017328
S.E. of regression	0.015098	Akaike info criterion	-5.524948
Sum squared resid	0.028039	Schwarz criterion	-5.457417
Log likelihood	351.0717	Hannan-Quinn criter.	-5.497512
F-statistic	20.82493	Durbin-Watson stat	2.160570
Prob(F-statistic)	0.000000		

Null Hypothesis: LBD has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.141312	0.9937
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000289
HAC corrected variance (Bartlett kernel)	0.000901

Phillips-Perron Test Equation
Dependent Variable: D(LBD)
Method: Least Squares
Date: 01/24/23 Time: 14:58
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LBD(-1)	0.011875	0.010437	1.137762	0.2574
C	-0.121177	0.138457	-0.875198	0.3832
@TREND("1990Q1")	-0.000491	0.000305	-1.610797	0.1098

R-squared	0.100480	Mean dependent var	0.026870
Adjusted R-squared	0.085972	S.D. dependent var	0.017998
S.E. of regression	0.017206	Akaike info criterion	-5.263722
Sum squared resid	0.036712	Schwarz criterion	-5.196536
Log likelihood	337.2463	Hannan-Quinn criter.	-5.236425
F-statistic	6.925668	Durbin-Watson stat	1.034745
Prob(F-statistic)	0.001408		

Null Hypothesis: D(LBD) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.824332	0.0000
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000223
HAC corrected variance (Bartlett kernel)	0.000273

Phillips-Perron Test Equation
Dependent Variable: D(LBD,2)
Method: Least Squares
Date: 01/24/23 Time: 14:58
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBD(-1))	-0.506191	0.078449	-6.452475	0.0000
C	0.018094	0.003967	4.561311	0.0000
@TREND("1990Q1")	-7.15E-05	3.88E-05	-1.842233	0.0678

R-squared	0.252960	Mean dependent var	-0.000128
Adjusted R-squared	0.240813	S.D. dependent var	0.017328
S.E. of regression	0.015098	Akaike info criterion	-5.524948
Sum squared resid	0.028039	Schwarz criterion	-5.457417
Log likelihood	351.0717	Hannan-Quinn criter.	-5.497512
F-statistic	20.82493	Durbin-Watson stat	2.160570
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDEF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.005584	0.1349
Test critical values:	1% level	-4.033727	
	5% level	-3.446464	
	10% level	-3.148223	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDEF)
Method: Least Squares
Date: 01/30/23 Time: 23:29
Sample (adjusted): 1991Q1 2021Q4
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDEF(-1)	-0.415433	0.138220	-3.005584	0.0032
D(LGDEF(-1))	-0.501653	0.129336	-3.878689	0.0002
D(LGDEF(-2))	-0.516719	0.106889	-4.834173	0.0000
D(LGDEF(-3))	-0.423293	0.084104	-5.032999	0.0000
C	0.379743	0.193423	1.963274	0.0520
@TREND("1990Q1")	0.000616	0.002313	0.266183	0.7906

R-squared	0.536522	Mean dependent var	0.004120
Adjusted R-squared	0.516883	S.D. dependent var	1.290713
S.E. of regression	0.897131	Akaike info criterion	2.667948
Sum squared resid	94.97167	Schwarz criterion	2.804414
Log likelihood	-159.4128	Hannan-Quinn criter.	2.723384
F-statistic	27.31933	Durbin-Watson stat	1.972585
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LGDEF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.38819	0.0000
Test critical values:	1% level	-4.033727	
	5% level	-3.446464	
	10% level	-3.148223	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDEF,2)
Method: Least Squares
Date: 01/30/23 Time: 23:31
Sample (adjusted): 1991Q1 2021Q4
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDEF(-1))	-3.062808	0.199036	-15.38819	0.0000
D(LGDEF(-1),2)	1.248786	0.143267	8.716478	0.0000
D(LGDEF(-2),2)	0.525174	0.079526	6.603824	0.0000
C	0.091895	0.173629	0.529262	0.5976
@TREND("1990Q1")	-0.000990	0.002326	-0.425485	0.6713

R-squared	0.820635	Mean dependent var	-0.012863
Adjusted R-squared	0.814606	S.D. dependent var	2.152749
S.E. of regression	0.926919	Akaike info criterion	2.725586
Sum squared resid	102.2423	Schwarz criterion	2.839307
Log likelihood	-163.9863	Hannan-Quinn criter.	2.771782
F-statistic	136.1126	Durbin-Watson stat	2.041716
Prob(F-statistic)	0.000000		

Null Hypothesis: LGDEF has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.47043	0.0000
Test critical values:	1% level	-4.031899	
	5% level	-3.445590	
	10% level	-3.147710	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.955328
HAC corrected variance (Bartlett kernel)	1.733291

Phillips-Perron Test Equation
Dependent Variable: D(LGDEF)
Method: Least Squares
Date: 01/30/23 Time: 23:33
Sample (adjusted): 1990Q2 2021Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDEF(-1)	-0.845148	0.087949	-9.609564	0.0000
C	0.628812	0.185493	3.389956	0.0009
@TREND("1990Q1")	0.002757	0.002429	1.135180	0.2585

R-squared	0.427451	Mean dependent var	0.009480
Adjusted R-squared	0.418216	S.D. dependent var	1.296840
S.E. of regression	0.989162	Akaike info criterion	2.839421
Sum squared resid	121.3267	Schwarz criterion	2.906606
Log likelihood	-177.3032	Hannan-Quinn criter.	2.866717
F-statistic	46.28761	Durbin-Watson stat	1.955669
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LGDEF) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-31.24261	0.0001
Test critical values:	1% level	-4.032498	
	5% level	-3.445877	
	10% level	-3.147878	

*MacKinnon (1996) one-sided p-values.

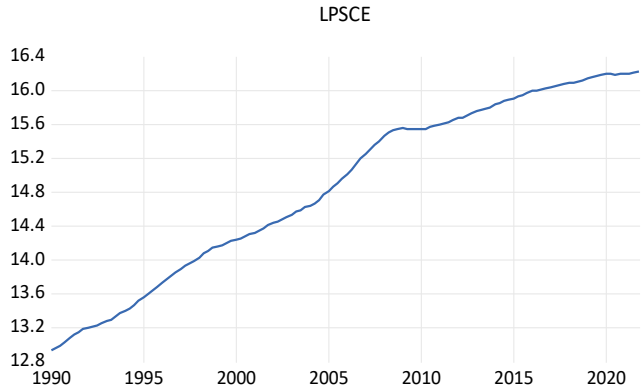
Residual variance (no correction)	1.365381
HAC corrected variance (Bartlett kernel)	0.229594

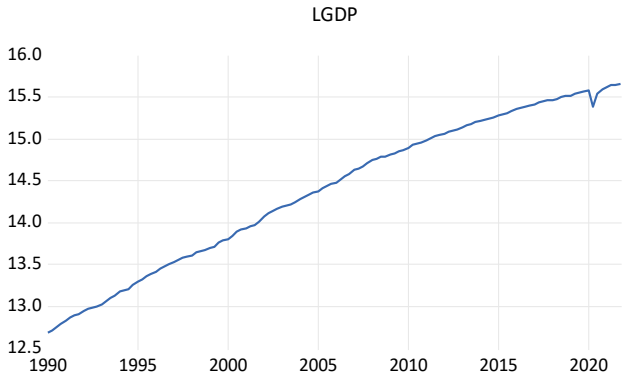
Phillips-Perron Test Equation
Dependent Variable: D(LGDEF,2)
Method: Least Squares
Date: 01/30/23 Time: 23:33
Sample (adjusted): 1990Q3 2021Q4
Included observations: 126 after adjustments

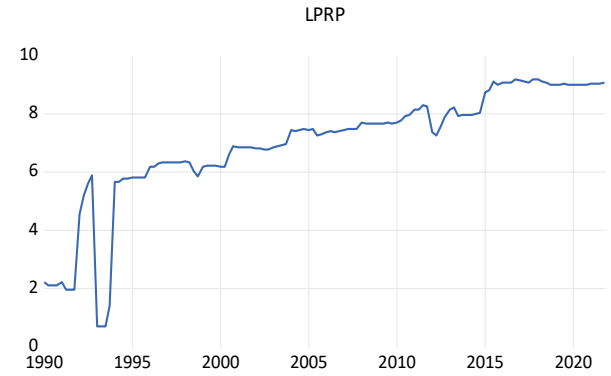
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDEF(-1))	-1.407927	0.082432	-17.07977	0.0000
C	0.027194	0.214530	0.126759	0.8993
@TREND("1990Q1")	-0.000382	0.002897	-0.131768	0.8954

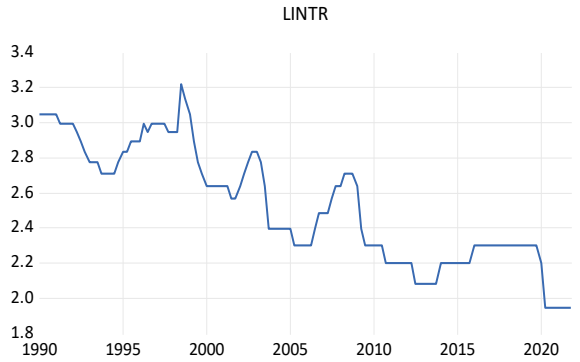
R-squared	0.703413	Mean dependent var	-0.038170
Adjusted R-squared	0.698591	S.D. dependent var	2.154178
S.E. of regression	1.182659	Akaike info criterion	3.196930
Sum squared resid	172.0380	Schwarz criterion	3.264460
Log likelihood	-198.4066	Hannan-Quinn criter.	3.224365
F-statistic	145.8594	Durbin-Watson stat	2.339484
Prob(F-statistic)	0.000000		

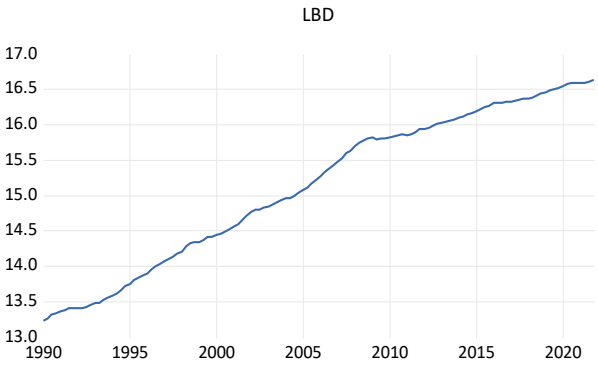
Visual inspection for both ADF & PP at level

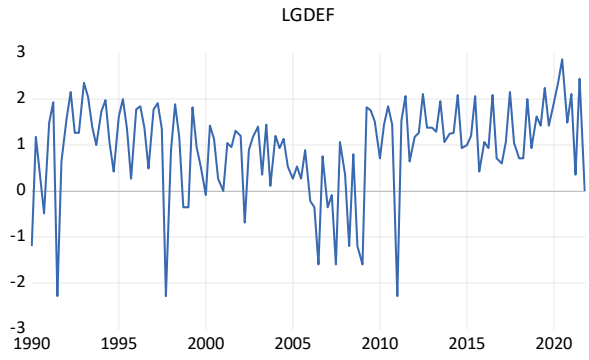




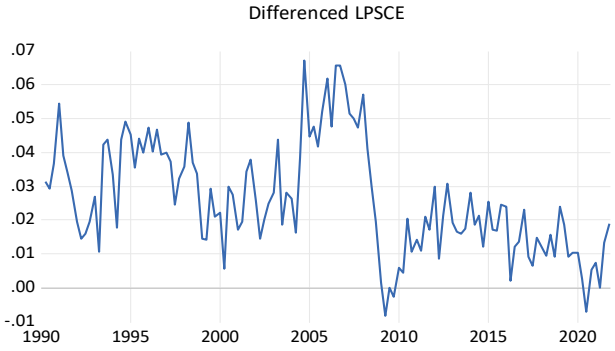


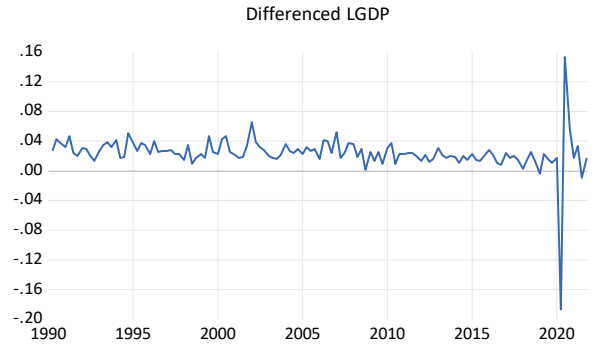


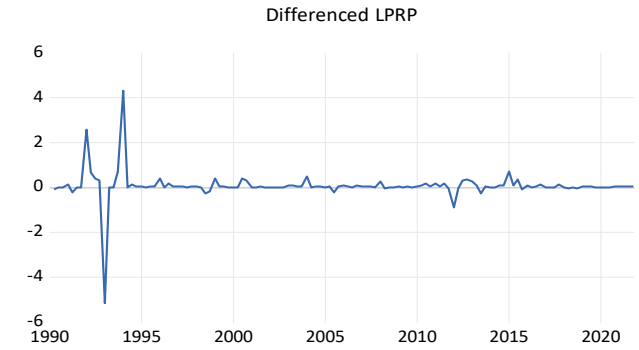


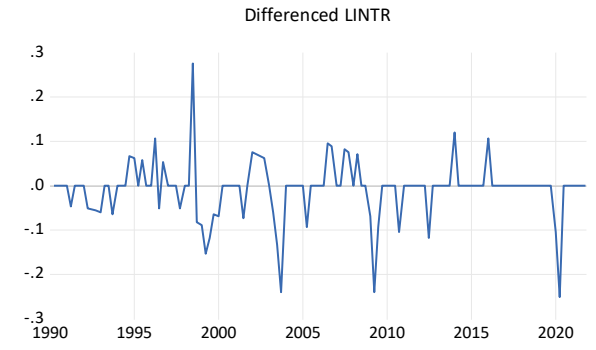


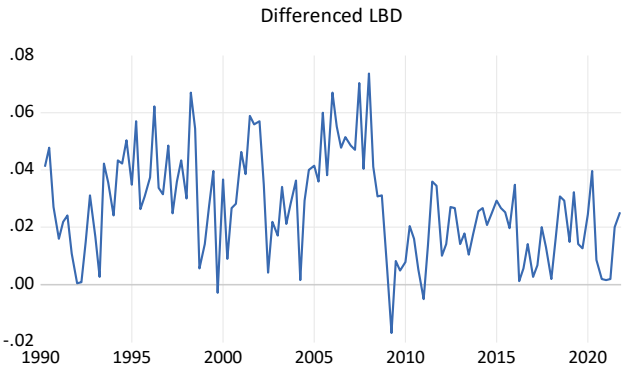
Visual inspection for both ADF & PP at first difference

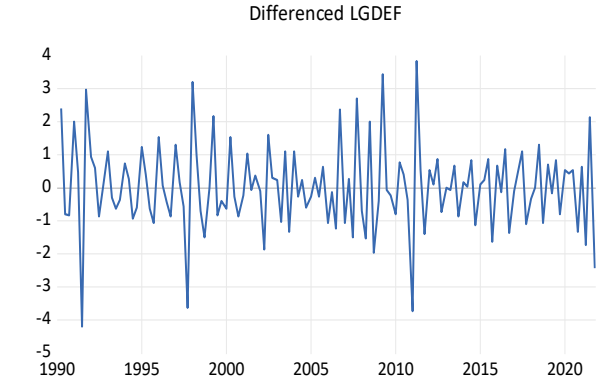












ARDL test

Dependent Variable: LPSCE1
Method: ARDL
Date: 09/13/23 Time: 19:11
Sample (adjusted): 1990Q4 2021Q4
Included observations: 125 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): LGDP1 LPRP1 LINTR1 LBD1 LGDEF1
Fixed regressors: C
Number of models evaluated: 1024
Selected Model: ARDL(1, 2, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LPSCE1(-1)	0.484878	0.067473	7.186279	0.0000
LGDP1	0.079628	0.037614	2.117013	0.0364
LGDP1(-1)	0.104999	0.037193	2.823102	0.0056
LGDP1(-2)	0.055365	0.036125	1.532597	0.1281
LPRP1	-0.000738	0.001247	-0.591992	0.5550
LINTR1	-0.002806	0.014392	-0.194997	0.8457
LBD1	0.351438	0.058993	5.957308	0.0000
LGDEF1	-4.89E-05	0.000649	-0.075418	0.9400
C	-0.001605	0.002334	-0.687482	0.4932

R-squared	0.709725	Mean dependent var	0.025967
Adjusted R-squared	0.689706	S.D. dependent var	0.016515
S.E. of regression	0.009200	Akaike info criterion	-6.469997
Sum squared resid	0.009818	Schwarz criterion	-6.266358
Log likelihood	413.3748	Hannan-Quinn criter.	-6.387269
F-statistic	35.45259	Durbin-Watson stat	2.218076
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Long run form and Bounds test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LPSCE1)
Selected Model: ARDL(1, 2, 0, 0, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 09/13/23 Time: 19:14
Sample: 1990Q1 2021Q4
Included observations: 125

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001605	0.002334	-0.687482	0.4932
LPSCE1(-1)*	-0.515122	0.067473	-7.634527	0.0000
LGDP1(-1)	0.239992	0.079911	3.003221	0.0033
LPRP1**	-0.000738	0.001247	-0.591992	0.5550
LINTR1**	-0.002806	0.014392	-0.194997	0.8457
LBD1**	0.351438	0.058993	5.957308	0.0000
LGDEF1**	-4.89E-05	0.000649	-0.075418	0.9400
D(LGDP1)	0.079628	0.037614	2.117013	0.0364
D(LGDP1(-1))	-0.055365	0.036125	-1.532597	0.1281

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP1	0.465893	0.148248	3.142664	0.0021
LPRP1	-0.001433	0.002441	-0.587346	0.5581
LINTR1	-0.005448	0.028003	-0.194547	0.8461
LBD1	0.682241	0.096691	7.055895	0.0000
LGDEF1	-9.50E-05	0.001261	-0.075375	0.9400
C	-0.003115	0.004599	-0.677291	0.4996

EC = LPSCE1 - (0.4659*LGDP1 -0.0014*LPRP1 -0.0054*LINTR1 + 0.6822 *LBD1 -0.0001*LGDEF1 - 0.0031)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	9.181834	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	125	Finite Sample: n=80		
		10%	2.303	3.154
		5%	2.55	3.606
		1%	3.351	4.587

ARDL ECM version

ARDL Error Correction Regression
Dependent Variable: D(LPSCE1)
Selected Model: ARDL(1, 2, 0, 0, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 09/13/23 Time: 19:16
Sample: 1990Q1 2021Q4
Included observations: 125

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP1)	0.079628	0.027090	2.939366	0.0040
D(LGDP1(-1))	-0.055365	0.026979	-2.052106	0.0424
CointEq(-1)*	-0.515122	0.062654	-8.221757	0.0000

R-squared	0.360595	Mean dependent var	-8.24E-05
Adjusted R-squared	0.350113	S.D. dependent var	0.011128
S.E. of regression	0.008971	Akaike info criterion	-6.565997
Sum squared resid	0.009818	Schwarz criterion	-6.498117
Log likelihood	413.3748	Hannan-Quinn criter.	-6.538421
Durbin-Watson stat	2.218076		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	9.181834	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Diagnostic Tests

Heteroscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.939576	Prob. F(8,116)	0.4870
Obs*R-squared	7.606881	Prob. Chi-Square(8)	0.4728
Scaled explained SS	8.141764	Prob. Chi-Square(8)	0.4197

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/13/23 Time: 19:19
Sample: 1990Q4 2021Q4
Included observations: 125

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.11E-05	3.16E-05	0.667987	0.5055
LPSCE1(-1)	-0.000174	0.000914	-0.190726	0.8491
LGDP1	0.000515	0.000509	1.012084	0.3136
LGDP1(-1)	0.000726	0.000504	1.441849	0.1520
LGDP1(-2)	0.000726	0.000489	1.484991	0.1403
LPRP1	-1.24E-05	1.69E-05	-0.736262	0.4631
LINTR1	0.000106	0.000195	0.543019	0.5882
LBD1	0.000657	0.000799	0.821868	0.4128
LGDEF1	-2.78E-06	8.79E-06	-0.315873	0.7527

R-squared	0.060855	Mean dependent var	7.85E-05
Adjusted R-squared	-0.003914	S.D. dependent var	0.000124
S.E. of regression	0.000125	Akaike info criterion	-15.07411
Sum squared resid	1.80E-06	Schwarz criterion	-14.87047
Log likelihood	951.1318	Hannan-Quinn criter.	-14.99138
F-statistic	0.939576	Durbin-Watson stat	1.830025
Prob(F-statistic)	0.486959		

Heteroskedasticity Test: Harvey
Null hypothesis: Homoskedasticity

F-statistic	1.700952	Prob. F(8,116)	0.1053
Obs*R-squared	13.12386	Prob. Chi-Square(8)	0.1077
Scaled explained SS	11.46337	Prob. Chi-Square(8)	0.1768

Test Equation:
Dependent Variable: LRESID2
Method: Least Squares
Date: 09/13/23 Time: 19:20
Sample: 1990Q4 2021Q4
Included observations: 125

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.14043	0.517251	-21.53776	0.0000
LPSCE1(-1)	-2.390811	14.95376	-0.159880	0.8733
LGDP1	-0.539757	8.336170	-0.064749	0.9485
LGDP1(-1)	-1.727539	8.242890	-0.209579	0.8344
LGDP1(-2)	15.55023	8.006198	1.942274	0.0545
LPRP1	-0.725102	0.276433	-2.623065	0.0099
LINTR1	2.174123	3.189563	0.681637	0.4968
LBD1	8.319181	13.07437	0.636297	0.5258
LGDEF1	0.100687	0.143837	0.700008	0.4853

R-squared	0.104991	Mean dependent var	-10.72612
Adjusted R-squared	0.043266	S.D. dependent var	2.084512
S.E. of regression	2.038919	Akaike info criterion	4.331993
Sum squared resid	482.2342	Schwarz criterion	4.535632
Log likelihood	-261.7496	Hannan-Quinn criter.	4.414721
F-statistic	1.700952	Durbin-Watson stat	1.668205
Prob(F-statistic)	0.105339		

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

F-statistic	1.074303	Prob. F(8,116)	0.3860
Obs*R-squared	8.622402	Prob. Chi-Square(8)	0.3751
Scaled explained SS	8.419074	Prob. Chi-Square(8)	0.3936

Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Date: 09/13/23 Time: 19:21
Sample: 1990Q4 2021Q4
Included observations: 125

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004650	0.001392	3.339128	0.0011
LPSCE1(-1)	-0.004790	0.040256	-0.118976	0.9055
LGDP1	0.015780	0.022441	0.703170	0.4834
LGDP1(-1)	0.026158	0.022190	1.178822	0.2409
LGDP1(-2)	0.039850	0.021553	1.848927	0.0670
LPRP1	-0.000908	0.000744	-1.220582	0.2247
LINTR1	0.006260	0.008586	0.729005	0.4675
LBD1	0.023493	0.035197	0.667473	0.5058
LGDEF1	-6.28E-05	0.000387	-0.162063	0.8715

R-squared	0.068979	Mean dependent var	0.006965
Adjusted R-squared	0.004771	S.D. dependent var	0.005502
S.E. of regression	0.005489	Akaike info criterion	-7.502916
Sum squared resid	0.003495	Schwarz criterion	-7.299278
Log likelihood	477.9323	Hannan-Quinn criter.	-7.420189
F-statistic	1.074303	Durbin-Watson stat	1.710920
Prob(F-statistic)	0.385975		

Heteroskedasticity Test: ARCH

F-statistic	1.958951	Prob. F(1,122)	0.1642
Obs*R-squared	1.959600	Prob. Chi-Square(1)	0.1616

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/13/23 Time: 19:22
Sample (adjusted): 1991Q1 2021Q4
Included observations: 124 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.90E-05	1.32E-05	5.210659	0.0000
RESID^2(-1)	0.125800	0.089881	1.399625	0.1642

R-squared	0.015803	Mean dependent var	7.89E-05
Adjusted R-squared	0.007736	S.D. dependent var	0.000125
S.E. of regression	0.000124	Akaike info criterion	-15.13200
Sum squared resid	1.88E-06	Schwarz criterion	-15.08652
Log likelihood	940.1843	Hannan-Quinn criter.	-15.11353
F-statistic	1.958951	Durbin-Watson stat	1.786702
Prob(F-statistic)	0.164163		

Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.186901	Prob. F(2,114)	0.3089
Obs*R-squared	2.549761	Prob. Chi-Square(2)	0.2795

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 09/13/23 Time: 19:23
Sample: 1990Q4 2021Q4
Included observations: 125
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE1(-1)	0.081762	0.089689	0.911616	0.3639
LGDP1	-0.004215	0.037657	-0.111933	0.9111
LGDP1(-1)	-0.010020	0.037708	-0.265739	0.7909
LGDP1(-2)	-0.012364	0.037034	-0.333858	0.7391
LPRP1	0.000119	0.001251	0.095031	0.9245
LINTR1	5.78E-05	0.014532	0.003977	0.9968
LBD1	-0.019316	0.060394	-0.319830	0.7497
LGDEF1	1.51E-06	0.000649	0.002320	0.9982
C	-0.001005	0.002485	-0.404408	0.6867
RESID(-1)	-0.189379	0.123784	-1.529912	0.1288
RESID(-2)	-0.042987	0.106800	-0.402500	0.6881

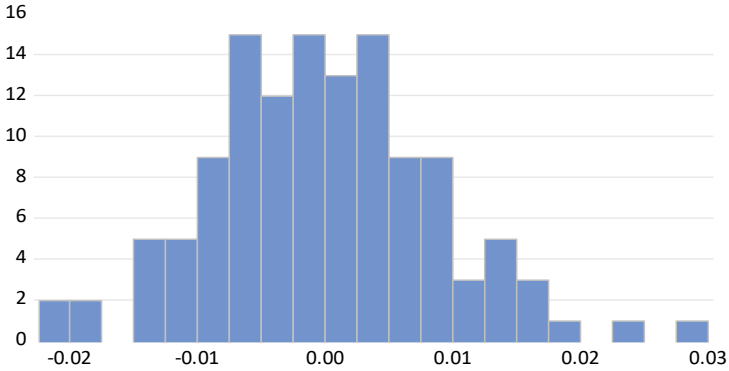
R-squared	0.020398	Mean dependent var	-3.80E-18
Adjusted R-squared	-0.065532	S.D. dependent var	0.008898
S.E. of regression	0.009185	Akaike info criterion	-6.458606
Sum squared resid	0.009618	Schwarz criterion	-6.209714
Log likelihood	414.6629	Hannan-Quinn criter.	-6.357494
F-statistic	0.237380	Durbin-Watson stat	2.001381
Prob(F-statistic)	0.991843		

Multicolinearity

Variance Inflation Factors
Date: 09/13/23 Time: 19:24
Sample: 1990Q1 2021Q4
Included observations: 125

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LPSCE1(-1)	0.004553	6.379799	1.817107
LGDP1	0.001415	2.416907	1.293880
LGDP1(-1)	0.001383	2.387614	1.269881
LGDP1(-2)	0.001305	2.261156	1.180920
LPRP1	1.56E-06	1.022176	1.015021
LINTR1	0.000207	1.292361	1.268732
LBD1	0.003480	5.285637	1.651636
LGDEF1	4.21E-07	1.023368	1.023363
C	5.45E-06	8.044752	NA

Normality Test



Series: Residuals
Sample 1990Q4 2021Q4
Observations 125

Mean	-3.80e-18
Median	-0.000332
Maximum	0.029751
Minimum	-0.020381
Std. Dev.	0.008898
Skewness	0.335077
Kurtosis	3.485684
Jarque-Bera	3.567687
Probability	0.167991

Specification test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LPSCE1 LPSCE1(-1) LGDP1 LGDP1(-1) LGDP1(-2) LPRP1 LINTR1 LBD1 LGDEF1 C

	Value	df	Probability
t-statistic	0.476115	115	0.6349
F-statistic	0.226686	(1, 115)	0.6349
Likelihood ratio	0.246155	1	0.6198

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	1.93E-05	1	1.93E-05
Restricted SSR	0.009818	116	8.46E-05
Unrestricted SSR	0.009798	115	8.52E-05

LR test summary:

	Value
Restricted LogL	413.3748
Unrestricted LogL	413.4979

Unrestricted Test Equation:
Dependent Variable: LPSCE1
Method: Least Squares
Date: 09/13/23 Time: 19:26
Sample: 1990Q4 2021Q4
Included observations: 125

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPSCE1(-1)	0.539420	0.133066	4.053785	0.0001
LGDP1	0.087570	0.041261	2.122324	0.0360
LGDP1(-1)	0.111351	0.039631	2.809721	0.0058
LGDP1(-2)	0.057296	0.036472	1.570962	0.1189
LPRP1	-0.000823	0.001264	-0.651200	0.5162
LINTR1	-0.002897	0.014441	-0.200638	0.8413
LBD1	0.389595	0.099632	3.910342	0.0002
LGDEF1	-4.43E-05	0.000651	-0.067950	0.9459
C	-0.002790	0.003419	-0.816225	0.4161
FITTED^2	-1.874707	3.937507	-0.476115	0.6349

R-squared	0.710296	Mean dependent var	0.025967
Adjusted R-squared	0.687623	S.D. dependent var	0.016515
S.E. of regression	0.009231	Akaike info criterion	-6.455966
Sum squared resid	0.009798	Schwarz criterion	-6.229701
Log likelihood	413.4979	Hannan-Quinn criter.	-6.364046
F-statistic	31.32852	Durbin-Watson stat	2.214604
Prob(F-statistic)	0.000000		

Appendix 8.7 Demand side empirical results with structural breaks

ARDL with Dummy variable

Dependent Variable: LPSCE1
Method: ARDL
Date: 01/27/24 Time: 14:58
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): DUM LGDP1 LINTR1 LINFL LREER LPRP1 LRWR1 LPUBSC
Fixed regressors: C
Number of models evalulated: 390625
Selected Model: ARDL(1, 3, 4, 0, 0, 0, 4, 3, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LPSCE1(-1)	0.712191	0.062212	11.44786	0.0000
DUM	0.014453	0.007905	1.828420	0.0705
DUM(-1)	-0.015885	0.009475	-1.676450	0.0968
DUM(-2)	0.009117	0.009846	0.925973	0.3567
DUM(-3)	-0.021138	0.007726	-2.735877	0.0074
LGDP1	0.014326	0.043601	0.328571	0.7432
LGDP1(-1)	0.005502	0.044682	0.123129	0.9023
LGDP1(-2)	0.011577	0.044860	0.258079	0.7969
LGDP1(-3)	0.031806	0.042970	0.740174	0.4609
LGDP1(-4)	0.091675	0.034931	2.624462	0.0101
LINTR1	0.018313	0.014413	1.270658	0.2068
LINFL	-0.004650	0.001364	-3.409500	0.0009
LREER	0.000530	0.000821	0.646177	0.5197
LPRP1	-0.002391	0.003560	-0.671836	0.5033
LPRP1(-1)	0.002908	0.003734	0.778807	0.4380
LPRP1(-2)	0.014159	0.003836	3.690877	0.0004
LPRP1(-3)	0.007509	0.003990	1.882045	0.0628
LPRP1(-4)	-0.007395	0.003620	-2.042801	0.0437
LRWR1	0.025473	0.032296	0.788753	0.4321
LRWR1(-1)	0.093152	0.034328	2.713611	0.0079
LRWR1(-2)	0.057899	0.033535	1.726512	0.0874
LRWR1(-3)	0.059950	0.031807	1.884791	0.0624
LPUBSC	-0.000704	0.000679	-1.037642	0.3020
C	0.012054	0.007631	1.579732	0.1174

R-squared	0.790609	Mean dependent var	0.025650
Adjusted R-squared	0.741963	S.D. dependent var	0.016419
S.E. of regression	0.008340	Akaike info criterion	-6.562286
Sum squared resid	0.006886	Schwarz criterion	-6.013567
Log likelihood	427.5806	Hannan-Quinn criter.	-6.339398
F-statistic	16.25218	Durbin-Watson stat	2.308113
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Cointegration and long-run form

ARDL Cointegrating And Long Run Form
Original dep. variable: LPSCE1
Selected Model: ARDL(1, 3, 4, 0, 0, 0, 4, 3, 0)
Date: 01/27/24 Time: 15:00

Sample: 1990Q1 2021Q4
Included observations: 123

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DUM)	0.014476	0.007025	2.060668	0.0420
D(DUM(-1))	0.010664	0.006575	1.621820	0.1080
D(DUM(-2))	0.019677	0.007244	2.716332	0.0078
D(LGDP1)	0.003065	0.029537	0.103780	0.9176
D(LGDP1(-1))	-0.125234	0.046527	-2.691641	0.0083
D(LGDP1(-2))	-0.117403	0.044003	-2.668083	0.0089
D(LGDP1(-3))	-0.089115	0.030774	-2.895776	0.0047
LINTR1	0.013100	0.013737	0.953586	0.3426
LINFL	-0.001740	0.001205	-1.443695	0.1520
LREER	0.000475	0.000787	0.603566	0.5475
D(LPRP1)	-0.004030	0.003143	-1.282274	0.2027
D(LPRP1(-1))	-0.014269	0.005203	-2.742436	0.0072
D(LPRP1(-2))	-0.001207	0.005095	-0.236896	0.8132
D(LPRP1(-3))	0.005704	0.003416	1.669579	0.0982
D(LRWR1)	0.015454	0.014212	1.087402	0.2795
D(LRWR1(-1))	-0.099973	0.024681	-4.050682	0.0001
D(LRWR1(-2))	-0.051047	0.014125	-3.613854	0.0005
LPUBSC	0.000284	0.000265	1.071772	0.2864
CointEq(-1)	-0.249219	0.047308	-5.267981	0.0000

Cointeq = LPSCE1 - (-0.0467*DUM + 0.5382*LGDP1 + 0.0636*LINTR1
-0.0162*LINFL + 0.0018*LREER + 0.0514*LPRP1 + 0.8216*LRWR1
-0.0024*LPUBSC + 0.0419)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUM	-0.046741	0.038112	-1.226418	0.2230
LGDP1	0.538155	0.494958	1.087273	0.2796
LINTR1	0.063631	0.049622	1.282299	0.2027
LINFL	-0.016158	0.005663	-2.853151	0.0053
LREER	0.001842	0.002916	0.631730	0.5290
LPRP1	0.051382	0.036672	1.401131	0.1643
LRWR1	0.821637	0.491218	1.672651	0.0976
LPUBSC	-0.002447	0.002263	-1.081406	0.2821
C	0.041883	0.024928	1.680172	0.0961

Bounds Test

ARDL Bounds Test
Date: 01/27/24 Time: 15:00
Sample: 1991Q2 2021Q4
Included observations: 123
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	3.499975	8

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.85	2.85
5%	2.11	3.15
2.5%	2.33	3.42
1%	2.62	3.47

Test Equation:
Dependent Variable: D(LPSCE1)
Method: Least Squares
Date: 01/27/24 Time: 15:00
Sample: 1991Q2 2021Q4
Included observations: 123

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DUM)	0.012178	0.008122	1.499303	0.1370
D(DUM(-1))	0.012931	0.008086	1.599192	0.1130
D(DUM(-2))	0.021957	0.008246	2.662613	0.0091
D(LGDP1)	-0.002081	0.043266	-0.048105	0.9617
D(LGDP1(-1))	-0.103381	0.097211	-1.063470	0.2902
D(LGDP1(-2))	-0.107382	0.065745	-1.633305	0.1056
D(LGDP1(-3))	-0.085516	0.035871	-2.383963	0.0190
D(LPRP1)	-0.002870	0.003674	-0.781090	0.4366
D(LPRP1(-1))	-0.010188	0.008754	-1.163860	0.2473
D(LPRP1(-2))	0.002182	0.006836	0.319159	0.7503
D(LPRP1(-3))	0.005976	0.003960	1.509153	0.1344
D(LRWR1)	0.035454	0.032702	1.084170	0.2809
D(LRWR1(-1))	-0.143099	0.064310	-2.225131	0.0283
D(LRWR1(-2))	-0.073078	0.032431	-2.253316	0.0264
C	-0.001135	0.008056	-0.140891	0.8882
DUM(-1)	-0.018267	0.010615	-1.720837	0.0884
LGDP1(-1)	0.099498	0.155775	0.638732	0.5245
LINTR1(-1)	0.015959	0.014998	1.064056	0.2899
LINFL(-1)	-0.002795	0.001425	-1.960866	0.0527
LREER(-1)	0.000555	0.000830	0.668194	0.5056
LPRP1(-1)	0.009036	0.011070	0.816223	0.4163
LRWR1(-1)	0.286253	0.125597	2.279132	0.0248
LPUBSC(-1)	0.000408	0.000709	0.575153	0.5665
LPSCE1(-1)	-0.267688	0.065308	-4.098826	0.0001

R-squared	0.505614	Mean dependent var	-0.000289
Adjusted R-squared	0.390756	S.D. dependent var	0.011078
S.E. of regression	0.008647	Akaike info criterion	-6.490144
Sum squared resid	0.007401	Schwarz criterion	-5.941425
Log likelihood	423.1439	Hannan-Quinn criter.	-6.267256
F-statistic	4.402101	Durbin-Watson stat	2.360809
Prob(F-statistic)	0.000000		

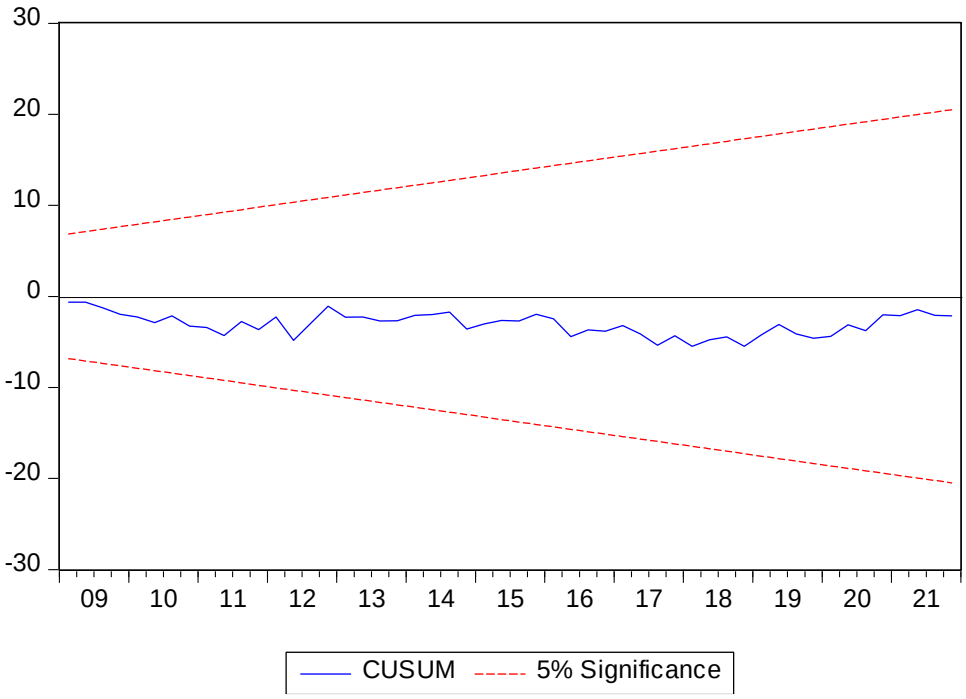
Multicolinearity

Variance Inflation Factors
Date: 01/27/24 Time: 15:10
Sample: 1990Q1 2021Q4
Included observations: 123

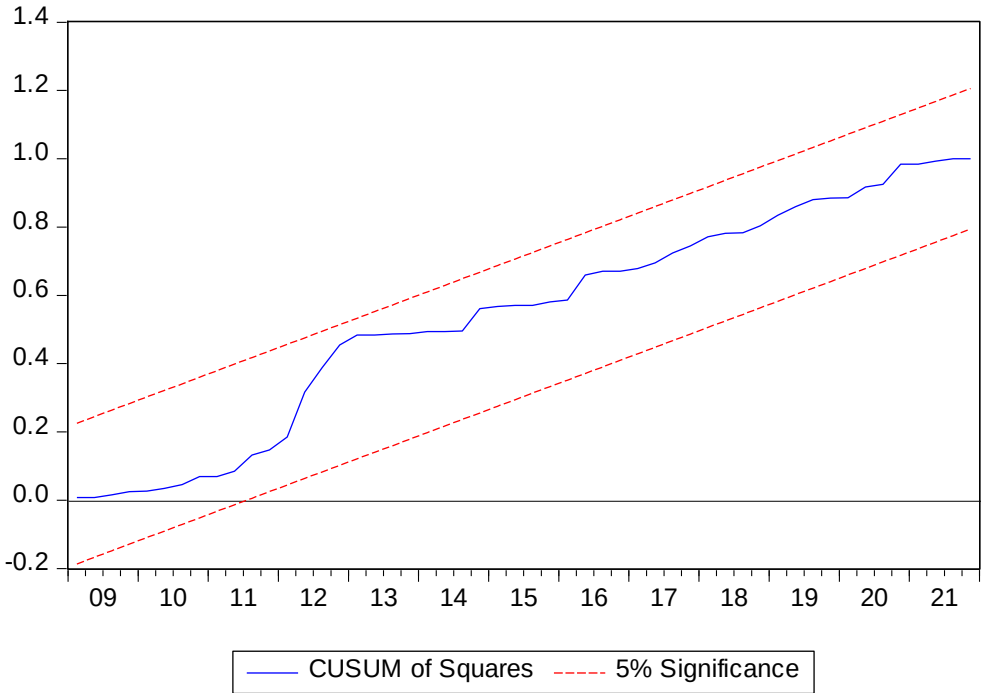
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LPSCE1(-1)	0.003870	6.477602	1.872861
DUM	6.25E-05	1.796606	1.767393
DUM(-1)	8.98E-05	2.581570	2.539593
DUM(-2)	9.69E-05	2.787373	2.742050
DUM(-3)	5.97E-05	1.716330	1.688422
LGDP1	0.001901	3.887328	2.108342
LGDP1(-1)	0.001996	4.103512	2.214773
LGDP1(-2)	0.002012	4.172862	2.206012
LGDP1(-3)	0.001846	3.846744	2.030741
LGDP1(-4)	0.001220	2.548593	1.341244
LINTR1	0.000208	1.577089	1.547785
LINFL	1.86E-06	10.87823	1.541982
LREER	6.73E-07	2.102636	1.358942
LPRP1	1.27E-05	1.341284	1.341284
LPRP1(-1)	1.39E-05	1.475594	1.475594
LPRP1(-2)	1.47E-05	1.557832	1.557832
LPRP1(-3)	1.59E-05	1.684929	1.684929
LPRP1(-4)	1.31E-05	1.387333	1.387333
LRWR1	0.001043	8.041085	7.015087
LRWR1(-1)	0.001178	9.174470	8.092515
LRWR1(-2)	0.001125	8.942765	7.865205
LRWR1(-3)	0.001012	8.016071	7.079585
LPUBSC	4.61E-07	64.05396	1.511846
C	5.82E-05	102.9634	NA

Stability tests

Cusum test



Cusum of Squares test



Appendix 8.8 Supply side empirical results with structural breaks

ARDL with Dummy variable

Dependent Variable: LPSCE1
Method: ARDL
Date: 01/27/24 Time: 15:18
Sample (adjusted): 1991Q2 2021Q4
Included observations: 123 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): DUM LGDP1 LPRP1 LINTR1 LBD1 LGDEF
Fixed regressors: C
Number of models evalulated: 15625
Selected Model: ARDL(1, 3, 4, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LPSCE1(-1)	0.433794	0.069515	6.240268	0.0000
DUM	0.001626	0.008174	0.198964	0.8427
DUM(-1)	-0.009078	0.009909	-0.916145	0.3616
DUM(-2)	0.003849	0.009793	0.393080	0.6950
DUM(-3)	-0.016812	0.008474	-1.983969	0.0498
LGDP1	0.074484	0.036346	2.049296	0.0429
LGDP1(-1)	0.091751	0.036777	2.494782	0.0141
LGDP1(-2)	0.064700	0.037222	1.738226	0.0850
LGDP1(-3)	0.042330	0.036488	1.160123	0.2486
LGDP1(-4)	0.079678	0.034341	2.320164	0.0222
LPRP1	-0.000823	0.001191	-0.690993	0.4911
LINTR1	-0.001671	0.013733	-0.121676	0.9034
LBD1	0.338487	0.058291	5.806820	0.0000
LGDEF	-0.001341	0.000924	-1.450833	0.1497
C	-0.001220	0.003088	-0.394947	0.6937

R-squared	0.747731	Mean dependent var	0.025650

Adjusted R-squared	0.715029	S.D. dependent var	0.016419
S.E. of regression	0.008765	Akaike info criterion	-6.522332
Sum squared resid	0.008296	Schwarz criterion	-6.179383
Log likelihood	416.1234	Hannan-Quinn criter.	-6.383027
F-statistic	22.86526	Durbin-Watson stat	2.292049
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Cointegration and long-run form

ARDL Cointegrating And Long Run Form
Original dep. variable: LPSCE1
Selected Model: ARDL(1, 3, 4, 0, 0, 0, 0)
Date: 01/27/24 Time: 15:23
Sample: 1990Q1 2021Q4
Included observations: 123

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DUM)	0.012746	0.008270	1.541262	0.1262
D(DUM(-1))	0.005826	0.007262	0.802252	0.4242
D(DUM(-2))	0.022382	0.008513	2.629207	0.0098
D(LGDP1)	0.050360	0.034714	1.450738	0.1498
D(LGDP1(-1))	-0.163448	0.056778	-2.878709	0.0048
D(LGDP1(-2))	-0.103448	0.048863	-2.117095	0.0365
D(LGDP1(-3))	-0.072955	0.033801	-2.158393	0.0331
LPRP1	-0.000635	0.001350	-0.470242	0.6391
LINTR1	-0.008672	0.014788	-0.586429	0.5588
LBD1	0.069524	0.034212	2.032128	0.0446
LGDEF	-0.001142	0.000798	-1.430292	0.1555
CointEq(-1)	-0.491614	0.088347	-5.564603	0.0000

Cointeq = LPSCE1 - (-0.0361*DUM + 0.6233*LGDP1 -0.0015*LPRP1 -0.0030*LINTR1 + 0.5978*LBD1 -0.0024*LGDEF -0.0022)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUM	-0.036056	0.019303	-1.867905	0.0645
LGDP1	0.623346	0.183364	3.399507	0.0009
LPRP1	-0.001453	0.002121	-0.685242	0.4947
LINTR1	-0.002951	0.024279	-0.121556	0.9035
LBD1	0.597816	0.090140	6.632089	0.0000
LGDEF	-0.002368	0.001603	-1.476852	0.1426
C	-0.002154	0.005479	-0.393112	0.6950

Bounds Test

ARDL Bounds Test

Date: 01/27/24 Time: 15:23
Sample: 1991Q2 2021Q4
Included observations: 123
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.539060	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Test Equation:
Dependent Variable: D(LPSCE1)
Method: Least Squares
Date: 01/27/24 Time: 15:23
Sample: 1991Q2 2021Q4
Included observations: 123

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DUM)	0.011373	0.009144	1.243799	0.2163
D(DUM(-1))	0.008990	0.009075	0.990640	0.3241
D(DUM(-2))	0.021007	0.009142	2.297968	0.0235
D(LGDP1)	0.055412	0.038467	1.440500	0.1526
D(LGDP1(-1))	-0.250001	0.091295	-2.738379	0.0072
D(LGDP1(-2))	-0.165914	0.065985	-2.514418	0.0134
D(LGDP1(-3))	-0.103856	0.039482	-2.630450	0.0098
C	-0.002446	0.003445	-0.709990	0.4792
DUM(-1)	-0.018186	0.011519	-1.578729	0.1173
LGDP1(-1)	0.405112	0.127853	3.168583	0.0020
LPRP1(-1)	-0.000319	0.001349	-0.236846	0.8132
LINTR1(-1)	0.002379	0.015593	0.152589	0.8790
LBD1(-1)	0.160361	0.073062	2.194872	0.0303
LGDEF(-1)	0.000508	0.000994	0.511511	0.6100
LPSCE1(-1)	-0.452886	0.087997	-5.146608	0.0000

R-squared	0.286152	Mean dependent var	-0.000289
Adjusted R-squared	0.193616	S.D. dependent var	0.011078
S.E. of regression	0.009948	Akaike info criterion	-6.269132
Sum squared resid	0.010687	Schwarz criterion	-5.926183
Log likelihood	400.5516	Hannan-Quinn criter.	-6.129827
F-statistic	3.092334	Durbin-Watson stat	2.287196
Prob(F-statistic)	0.000460		

Multicolinearity

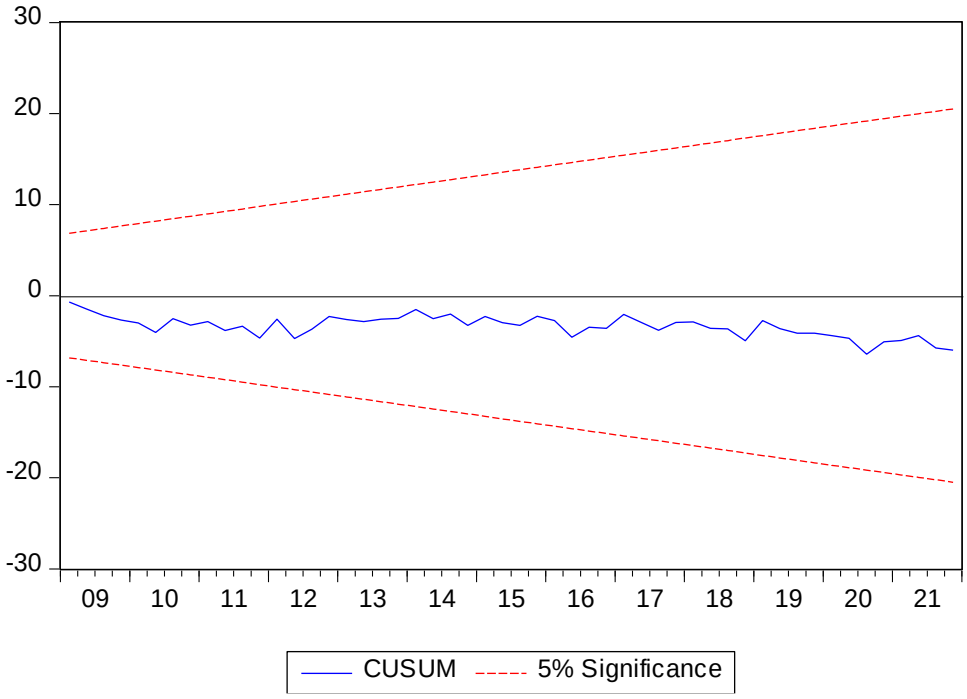
Variance Inflation Factors

Date: 01/27/24 Time: 15:27
Sample: 1990Q1 2021Q4
Included observations: 123

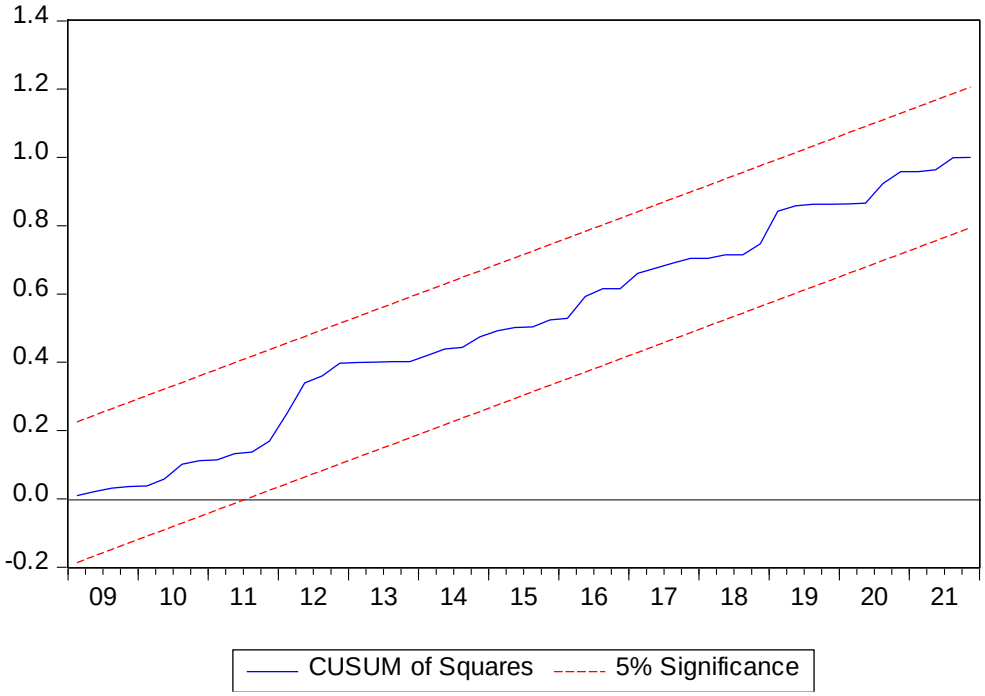
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LPSCE1(-1)	0.004832	7.323392	2.117404
DUM	6.68E-05	1.739626	1.711339
DUM(-1)	9.82E-05	2.556545	2.514975
DUM(-2)	9.59E-05	2.496637	2.456041
DUM(-3)	7.18E-05	1.869583	1.839183
LGDP1	0.001321	2.445977	1.326606
LGDP1(-1)	0.001353	2.517270	1.358637
LGDP1(-2)	0.001385	2.601280	1.375185
LGDP1(-3)	0.001331	2.511498	1.325849
LGDP1(-4)	0.001179	2.230455	1.173818
LPRP1	1.42E-06	1.026217	1.019160
LINTR1	0.000189	1.296592	1.272500
LBD1	0.003398	5.643371	1.771443
LGDEF	8.54E-07	2.638204	1.373328
C	9.54E-06	15.26833	NA

Stability tests

Cusum test



Cusum of squares test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0.6
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0.2
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09
10
11
12
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21
CUSUM of Squares
5% Significance