Determinants of mortgage lending:
A time series analysis from South Africa

A Dissertation

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by

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Dedication and acknowledgments

I dedicate my thesis to my late father, Douglas Davids, who passed on during the time of the writing of my dissertation due to COVID-19. He sacrificed greatly to ensure that I receive a tertiary education and always encouraged me in my pursuit of further education.

I would like to thank my Heavenly Father for granting me the grace and strength to complete my dissertation, a hugely challenging task amidst a very challenging time. I would like to thank Old Mutual Alternative Investments for sponsoring my studies and Professor Abdul Latif Alhassan for his patience and guidance in completing my dissertation. And lastly, a special thank you to my family for their unwavering love, support, patience and encouragement during the last few years of my studies.

Abstract

This study seeks to examine the influence of macroeconomic factors such as interest rates, inflation, GDP and house prices on mortgage lending in South Africa across different household income market segments (low, middle and high) as well as across different loan sizes (small, medium and large). Mortgage lending was further categorised by mortgage advances in rand value and volume and analysed using time series estimation techniques covering the period from Q4 2007 to Q4 2020.

The study found a positive and significant long-term relationship between GDP on the proportion of mortgages advanced to low- and middle-income households in rand value and volume. This relationship held true on the proportion of small and medium-size mortgages advanced in rand value as well as medium-size mortgages in volume. Furthermore, house prices and interest rates also had a positive long-term relationship with mortgages advanced to the low- and middle-income market as well as inflation on the volume of loans advanced to the low-income market segment. GDP, house prices and interest rates had a negative long-term relationship with the proportion of mortgages advanced to high-income households in rand value and volume. The majority of loans are advanced to the high-income market segment; thus, the results were found to be more in line with market theory and expectations. The impact of inflation was found to be mostly insignificant on the proportion of mortgages advanced to low-, middle- and high-income households in rand value but was found to be significant and negative for the proportion of mortgages advanced to middle- income households in volume. Inflation, interest rates and house prices had a highly significant and negative impact on the proportion of the volume of small mortgages advanced, which was expected as the lower end is much more sensitive to changes in interest rates and inflation.

The findings highlight that market forces influence market segments differently and housing policy interventions should be aligned with macro-economic policy and consider changing market conditions and its influence on different market segments in order to be effective in assisting with the goal of economic redistribution through home ownership.

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Abbreviations

SA	South Africa
SARB	South African Reserve Bank
ANC	African National Congress
RDP	Reconstruction and Development Programme
BNG	Breaking New Ground
FLISP	Finance Linked Individual Subsidy
NHFC	National Housing Finance Corporation
CAHF	Centre for Affordable Housing Finance
CPI	Consumer Price Index
PBHL	Pension Backed Housing Loan
GSP	Government Sponsored Properties
HHI	Household Income
NDP	National Development Plan
BASA	Banking Association of South Africa
HSDB	Human Settlements Development Bank
DHS	Department of Human Settlements
GHS	General Household Survey
FSC	Financial Sector Charter
NCR	National Credit Regulator
ADF	Augmented Dickey-Fuller
ARDL	Auto-Regressive Distributed Lag
ECM	Error Correction Model

Definition of terms

Mortgage Advance refers to mortgage loans disbursed by a financial institution

Housing demand refers to total mortgage applications as well as successful mortgage loans disbursed across low, middle and high-income households

Effective housing demand refers to successful mortgage loan advances to across low, middle and high-income households

Gini-coefficient is a measure of economic inequality in a society. According to OECD (n.d.) "it is the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. It can range from 0 to 100, where 0 reflects an equal distribution of income (where everyone has the same income) and 100 reflects absolute inequality (where one person has all the income and no-one else has anything)."

GAP market is defined as those households who earn too much to access fully subsidised housing and too little to access a bank home loan.

Repo rate is the interest rate at which banks borrow from the SARB for short periods of time to manage their liquidity.

Chapter 1

Introduction

1.1. Background of the study

"The frustration of working families unable to find affordable housing lies behind some of the recent land grabs. Housing policy has focused on building free houses for indigent households and neglected the struggles of low-wage earners to obtain decent homes."
~ Ivan Turok, Andreas Scheba (2018)

Increasing access to home ownership has been one of the core tenets of the National Development Plan 2030 (NDP) to enable the redistribution of wealth after nearly five decades of apartheid and exclusion of the majority of the population from the economic system. After 25 years of democracy, whilst significant progress has been made, the backlog of housing demand and need is continually rising due to population growth and urban migration, sluggish progress in housing delivery and disbursement of subsidies as well as banks' unwillingness to lend to the lower-income market (Muhuro, 2015; Turok & Scheba, 2018; Melzer & Hayworth, 2018).

Housing policy have actually excluded a large proportion of the GAP market to access home ownership and even though a subsidy has been available to the GAP market, the majority still have not been able to afford the cheapest unit on the market due to other challenges such as affordability constraints, poor credit worthiness, lack of affordable supply and banks' unwillingness to lend to this market.

The macro-economic environment has not been supportive in helping to improve the majority of households' socio-economic status. SA has struggled to recover from the global financial market crisis in 2008, having grown by an average of 1% per annum for the last 10 years (Statistics South Africa, 2020). Poor economic growth combined with a high unemployment rate of 27% has not boded well for the upliftment of households' wealth status and income growth.

Informal settlements in urban areas continue to rise as people are in search of jobs and better living conditions. Social unrest and increasing land invasions have been the result of growing frustration across the country due to a lack of decent and affordable housing and dissatisfaction with government's progress in delivery (Turok, 2018).

Housing policy makers must understand the needs of low-income earners for housing policy to be effective in enabling access to affordable housing finance (Limba, 2019).

1.2. Problem definition

The South African housing market is in crisis as most of the working population cannot afford to buy the cheapest unit on the market, even with government intervention such as the FLISP subsidy, designed specifically to assist them in their pursuit of home ownership (Turok, 2018). The cost of homes has increased by a cumulative 200% over the last 15 years (Venter, 2019). This segment of the population is defined as the GAP market, i.e., households earning too much to access a fully subsidised home and too little to access mortgage finance.

Historically, less than 5% of mortgage loans granted by the mortgage finance providers are to households earning less than R15 000 per month, who comprise more than 60% of the South African population (Van Heerden, 2020). Consumers are over-indebted and spending priorities are on the consumption debt rather than on wealth-building debt (Melzer & Hayworth, 2018). Banks are thus reluctant to lend to this market, as well as being curbed by excessive financial and credit regulations. Furthermore, banks generally apply a higher risk premium to this market and so they are more sensitive to interest-rate changes due to already low disposable income. The Office of Disclosure in the Department of Human Settlements reports that banks decline more than 50% of mortgage applications as a result (Melzer & Hayworth, 2018).

It is well documented that FLISP was ineffective for many years as it failed to adjust in line with rising house prices, and the majority in the gap market could not afford even the cheapest unit on the market (Venter, 2019). This demonstrates the failure of housing policy in meeting the housing needs of the working-class population (Turok, 2018).

Furthermore, due to the high rate of mortgage application rejections, developers often struggle to move already-built stock, adding an additional interest burden (interest carry or holding costs) on the development loan as income is delayed (CAHF, 2015).

The income and wealth inequality gap of the South African society will continue to widen if government does not create specific policy interventions.

This study attempts to explore the various macro-economic factors that influence mortgage supply, often reflected as effective housing demand, and to what extent it influences the different household-income market segments. This understanding may assist government to design specific and appropriate policy interventions for different segments of the market and ensure alignment of policies across state departments, i.e., housing and monetary policy.

The study will attempt to answer the following question:
How do interest rates, inflation, GDP and house prices influence mortgage supply as measured by successful mortgage advances for different household income segments of the market and across different loan sizes?

1.3. Research objectives and hypothesis

The objective of this study is to attempt to examine the factors that influence mortgage supply for housing across different household income market segments and across loan sizes of the market. The study specifically seeks:

- to examine the effect of macroeconomic factors on mortgage lending in South Africa.

1.4. Justification of the study

It is a national imperative to improve the wealth status of the majority, lower income South African population. The research will aim to give policy makers more insight into what factors are driving mortgage supply (or housing demand) across various income segments in the market. To be effective, housing policy needs to consider changes in the macro-economic environment and be flexible to adjust as required. Small changes in the macro-environment have a much larger impact on the lower end of the market as they are more sensitive to market movements with little margin to manoeuvre.

This study therefore seeks to contribute to the body of knowledge to understand the factors that influence the supply of mortgage finance across different market segments of society and thereby aid policy makers to design effective policies that adjust with market forces, continuing to be effective in assisting with the goal of economic redistribution through home ownership. The key beneficiaries of the research would be the South African government, particularly those setting housing policy, national and private housing agencies, developers and mortgage finance providers.

1.5. Organisation of the study

Chapter 1 explores the introduction and background to the study and includes the problem definition, research questions, statement of research problem, hypothesis to be tested, a summary of the literature review and justification for the study. Chapter 2 reviews the relevant literature applicable to the research questions. Chapter 3 outlines the research methodology employed. Chapter 4 presents the research findings and analysis. Chapter 5 presents the research conclusions, recommendations, and opportunity for future research.

Chapter 2

Literature Review

2.1 Introduction

This chapter presents an overview of housing demand and availability of mortgage finance across different household income segments of South Africa. Housing demand is measured by total mortgage applications as well as successful mortgage loans disbursed across low, middle- and high-income households, the latter being referred to as effective housing demand or mortgage supply. For this study, when housing demand is referenced, it excludes fully subsidised housing demand and demand from households not utilising a mortgage to finance the purchase.

Four key themes will be explored to present a theoretical framework of factors influencing housing demand. These are demand and supply side market dynamics and housing and macro-economic policy, which are expected to provide an indication of the relationships to expect in the analysis of factors influencing housing demand. A sample of empirical studies were investigated to contribute to the framework of the impact of macro and micro factors on different market segments.

2.2 Overview of the South African population by household income and wealth

In 2015, more than 80% of South Africa's 15.7 million households earned below R20 000 per month, of which approximately 30% earned below R3 500, 47% earned between R3 500 and R15 000, and only 6% earned above R15 000 as shown in Figure 1 (Melzer, 2016). The latter includes nurses, teachers, policemen, mechanics, bricklayers, secretaries, administrators, self-employed small businesses, etc. Furthermore, the diagram also shows how South Africans have been able to move up the wealth ladder since 2009.

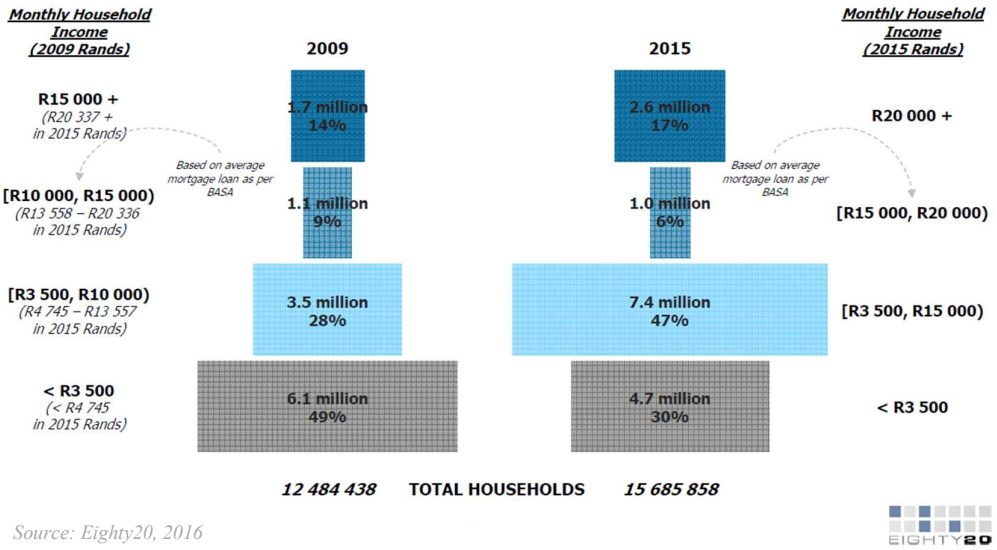


Figure 1:Household incomes in South Africa: 2009 vs 2015

South Africa is one of the most unequal societies in the world as measured by the Gini-coefficient, which measures income inequality between the rich and the poor (World Bank, 2021). South Africa's Gini-coefficient, last measured in 2014, was 0.63, the highest out of 149 countries with reported Gini-coefficients (World Bank, 2021). The top 10% of the population earn approximately 60% of total income. The middle class, comprising about 40% of the population, earn approximately 30%-35%, while the bottom 50% of the population are the poorest, earning only 10% of total income (Mpofu-Walsh, 2017; Orthofer, 2016).

A less reported phenomenon is the wealth inequality gap of the South African society. Wealth is defined as income including ownership of assets such as property, pension and policy fund investments and shares (Orthofer, 2016). Measured by wealth, the status quo is even more dire than on income alone. The table below shows the comparison between income and wealth inequality for different market segments. It shows the top 10% of the population own 90-95% of wealth, while the bottom 50% own almost nothing. Orthofer talks about the critical need to narrow the wealth inequality gap and for government to develop policies that enable the lower and middle class to create wealth.

Table 1:South African population distribution of income and wealth

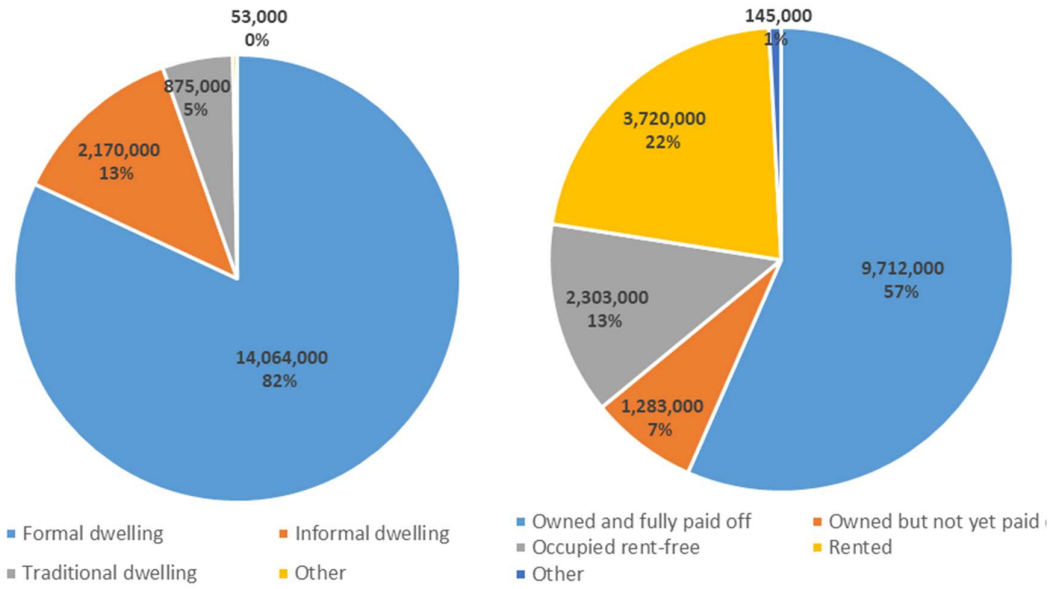
% Population	Income	Wealth
Top 10%	55-60%	90-95%
Next 40%	30-35%	5-10%
Bottom 50%	10%	0%

Source: Orthofer, 2016

The macro-economic environment has not been supportive in helping to improve the majority of households' socio-economic status. SA has struggled to recover from the global financial market crisis in 2008, having grown by an average of 1% per annum for the past 10 years (Statistics South Africa, 2020). Poor economic growth combined with a high unemployment rate of 27% has not boded well for the upliftment of households' wealth status and income growth. With inflation averaging 4%-6%, households have experienced negative real growth in wages over the past 10 years. The COVID-19 pandemic has worsened economic conditions for the majority of households in South Africa (World Bank, 2021).

2.3 Overview of the South African residential property market

According to the 2019 General Household Survey (GHS) published by Statistics South Africa (2020), the main dwelling type and tenure status of property is distributed across South African households as per the diagrams in Figure 2. In 2019, there were 17.16 million households in South Africa, of which 82% live in formal dwellings, with 57% of households owning fully paid-off homes and a further 7% owning but not yet having paid off their homes. Black South Africans comprise 85% of the 9.7 million households with homes fully paid off. Van Heerden (2020) states this is primarily due to the provision of fully subsidised housing by government. Over the five-year period between 2013 and 2019, the number of households owning, but not yet having paid off to a private lender, has declined by 36.5% (Van Heerden, 2020). This implies that banks are issuing fewer new mortgages.



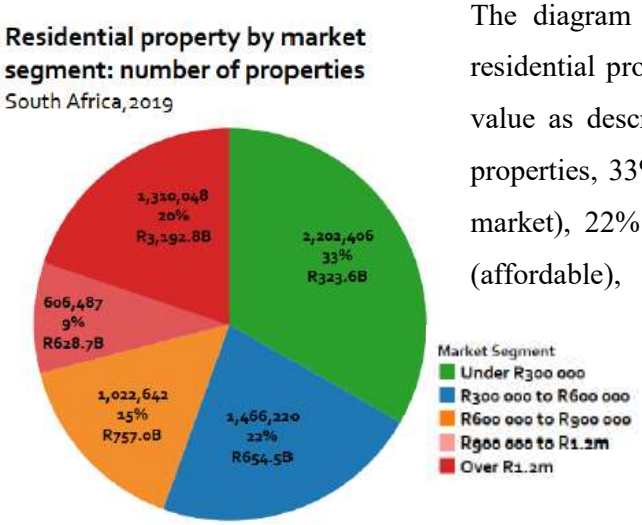
Source: Stats SA, General Household Survey 2019, Statistical release P0318, 17 December 2020, Table 8.5, p138

Figure 2:Distribution of households by main type of dwelling and by tenure status, 2019

In 2019, there were 6.6 million residential properties registered on the deeds registry (Nkhonajera & Namponya, 2020). The report categorises the residential property market into five segments according to value:

Table 2:Residential property market distribution by property value

Market Segment	Property Value
Entry market	Properties worth R300 000 or less
Affordable market	Properties worth R300 000 - R600 000
Conventional market	Properties worth R600 000 - R900 000
High-end market	Properties worth R900 000 - R1.2 million
Luxury market	Properties worth more than R1.2 million



The diagram alongside shows the categorisation of all residential properties registered in the Deeds Registry by value as described above. Of the 6.6 million residential properties, 33% were homes valued below R300K (entry market), 22% were valued between R300K and R600K (affordable), 15% between R600K and R900K (conventional), 9% between R900K and R1.2m (high-end) and 20% of properties were valued above R1.2m (luxury market).

Source: Nkhonajera, Namponya (2020)

Figure 3:Residential properties by market segment (2019)

The growth of each market segment from 2008 to 2019 is shown in the diagram below. The total number of residential properties on the deed's registry increased by 14% from 5.82 million properties in 2008 to 6.61 million in 2019. The affordable, conventional, high-end and luxury market segments all experienced positive annual growth in volume over the last 11 years, with the luxury market experiencing the highest growth of 152% over the period. The high-end experienced the second highest growth of 74% over the period, followed by conventional at 52% and affordable at only 15% growth. The number of properties in the entry level market (valued under R300K) declined by 27% over the period. The majority of the houses in this market segment are government-subsidised houses (BNG homes), comprising approximately 30% of total properties on the deeds registry. Evidently, the subsidised housing programme programme has had a significant impact on SA. However, there is a significant number of government-sponsored properties which are not yet registered due to the backlog in title deed registry (Rust & Tshangana, 2019). Rust and Tshangana (2019) believe that government-sponsored properties should comprise about 39% of the total market. In addition, government also has a significant backlog of more than 2.6 million houses still to be delivered (Thukwana, 2020). Positively, part of the slowdown in growth can also be attributed to the fact that as these properties increase in value, they shift into the affordable market segment (Rust & Tshangana, 2019). Yet, it is evident that the higher value properties grow faster in number than the lower value properties and that property is a wealth- generating asset.

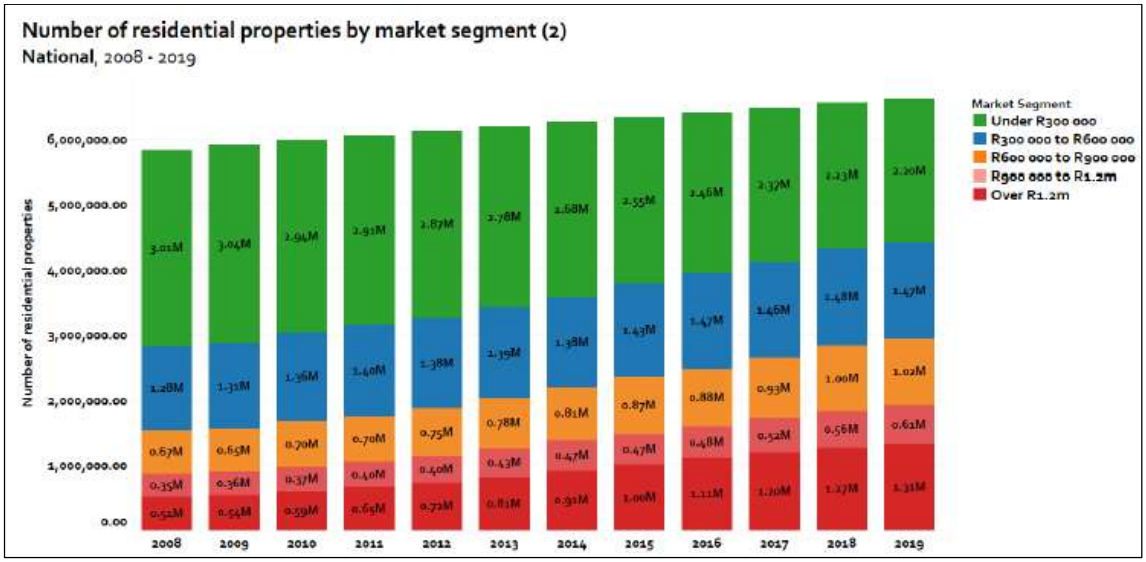


Figure 4: Properties categorised by value registered on the National Deeds Registry *Source: Nkhonajera, Namponya (2020)*

2.4 Overview of the South African mortgage finance market

South Africa is known to have a robust and sound banking sector. South African has 15 banks offering residential mortgage advances to the household sector (SARB, 2020); however, the key lenders of housing finance are the big four banks, First National Bank (FNB), Standard Bank, ABSA and Nedbank as evidenced in Figure 5. Figure 5 shows mortgages advanced by the banks to different market segments categorised by loan sizes. The diagram demonstrates that bank lending has been declining for lower income earners in both the new and resale market, but most notably in the entry and affordable markets.

Figure 5:Bank lending to different market segments *Source: Rust & Shangana (2019)*

In 2003 more than 100 financial market participants signed the Financial Sector Charter (FSC), thereby making a commitment to transform the financial services industry in line with the BEE Act to reduce inequality through economic and financial inclusion of the majority of the population (BASA, n.d.). This was to be achieved by directing investment into targeted sectors of the economy such as housing, education, agriculture, skills development and black SMEs and opening access to the financial markets. The FSC came into effect in 2004 and the financial sector market participants committed to originating a housing finance target of R42 billion between 2004 and 2008, which was to be extended to households earning between R1 500 and R7 500 per month and another R48 billion between 2012 and 2019 (BASA, n.d.). By 2009 the upper income threshold for the affordable market was revised to R15 142 per month on the back of increased infrastructure and building costs. By the same standards, the maximum house price affordable to the target market more than doubled to R350 000. The FSC income limits are adjusted annually by the midpoint of CPI (Consumer Price Inflation) and BCI (Building Cost Inflation). In 2018, the upper income limit for the affordable market was R23 300, which could afford a maximum house price of R616 000.

Carrim, Fubbs and Wicomb (2017) reported that the big four banks originated nearly 430 000 mortgage loans in the FSC/ affordable target market between 2004 and 2015, with a rand value of in excess of R80 billion.

Figure 6:Number of mortgages originated by income group (2008 – 2017)

Table 3:Mortgages granted by gross monthly income R'bn and Proportion (2009 & 2018)

Mortgages granted by gross monthly income, 2009 and 2018				
	—Rbn—		**Proportion**	
Income level	**2009[a]**	**2018[b]**	**2009[a]**	**2018[b]**
R0-R10 000	2 695	261	7.3%	0.6%
R10 100-R15 000	4 710	952	12.8%	2.3%
R15 000+	29 385	40 999	79.9%	97.1%
Total	**36 790**	**42 212**	**100.0%**	**100.0%**

Source: NCR, Consumer Credit Market Report, December 2009, p7; Consumer Credit Market Report, March 2019, p7; a Quarter ended December 2009; b Quarter ended December 2018

During 2018, less than 3% of total mortgages granted were extended to households earning up to R15 000 a month (National Credit Regulator, 2019). Muhoro (2015) highlights affordability constraints, over-indebtedness, poor credit ratings, and inadequate supply of housing as the biggest obstacles to home ownership for households in this income bracket, i.e., the GAP market.

Melzer and Hayworth (2018) proposed an alternative view to making mortgage markets work, showing that growth in bank lending has been very low to flat for a number of years and presents an alternative profitability model for banks to encourage lending. Mortgage margins trade very close to the long-term interest rate, highlighting that banks rarely price above 2%-3% above the prime lending rate. However, banking regulation allows banks to charge up to Prime +8%, thus they have the ability to charge higher lending rates to price for risk. Banks are very cautious to lend to the lower end because of reputational risk if they need to repossess homes (Melzer & Hayworth, 2018).

2.5 Demand side challenges influence on effective housing demand

The key constraints for households desiring to access to mortgage finance are affordability, creditworthiness and over-indebtedness.

a) Affordability

The FLISP policy, revised in 2018, included an increase in the upper income threshold from R15 000 to R22 000 as well as an increase in the quantum of the subsidy amount across income bands. Venter (2019) demonstrates that housing is still unaffordable for the majority of the GAP market. The graph below shows that even with the increased FLISP subsidy households earning

below R13 000 still cannot afford the cheapest basic house price on the market indicated by the black line. The purple line show what households with the associated income can afford, including the FLISP subsidy adjustments. The red area indicates the gap in affordability while the blue line indicates household incomes that can afford a greater amount than the basic house price.

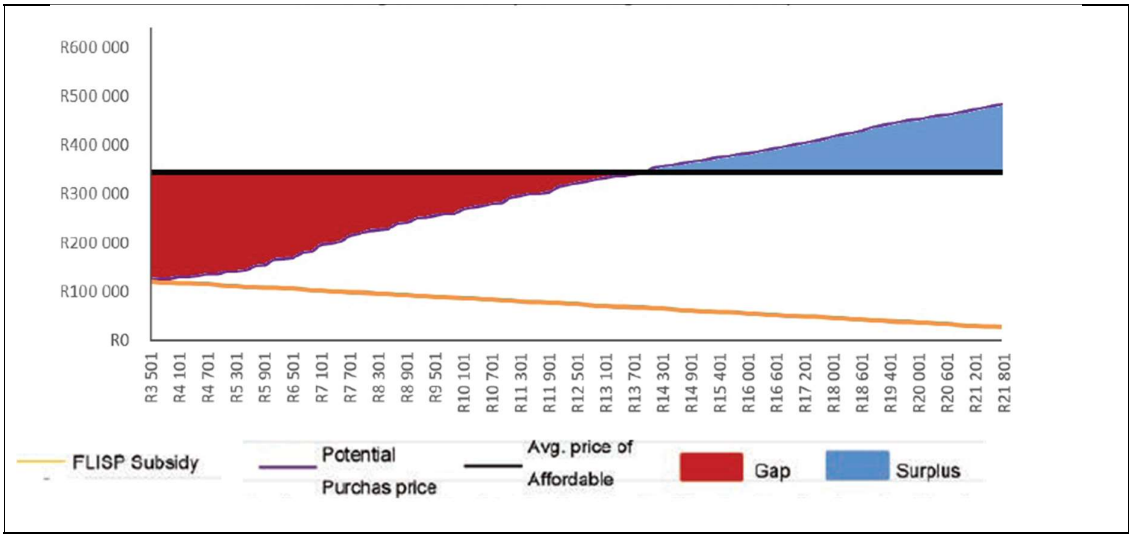


Figure 7:Housing affordability including FLISP Subsidy

Table 4:FSC affordable household Income thresholds and income affordability

	Affordable household Income threshold	Income affordability* (House Price)
2004	R7 500	R168 000
2009	R15 000	R306 000
2014	R18 595	R551 000
2019	R24 247	R616 000

**Assuming a 100% LTV 20-year mortgage at prime +2% & 30% of HHI used for home loan repayment*

In calculating income affordability, the following assumptions were made: a household is granted a 100% loan to value (LTV), 20-year mortgage with an interest rate of prime plus 2% and 30% of household income is utilised toward a home loan, i.e., bank estimate of affordability.

As shown in the table above, house prices almost doubled between 2004 and 2009 and then doubled again in the 10 years to 2019. This caused large shifts in the affordability limits, i.e., income required for bank approvals, yet household income for the majority of the population has hardly shifted by a fraction of this rate. In addition to building cost inflation, multiple layers of lengthy approval processes and municipal inefficiencies add to the cost of the house, well documented by the World Bank series publication of 'Doing business in SA'.

Annual adjustments in line with building cost inflation will be required to ensure FLISP keeps up with rising costs, otherwise the SA government will be back at square one in terms of support for the GAP market. The maximum mortgage value affordable to the FSC affordable market (income limit set annually) in relation to interest rates is shown in Figure 8, i.e., when interest rates increase, the mortgage value affordable to the affordable market decreases and when interest rates decline the maximum mortgage value increases. There is thus an inverse relationship between interest rates and mortgage value affordability.

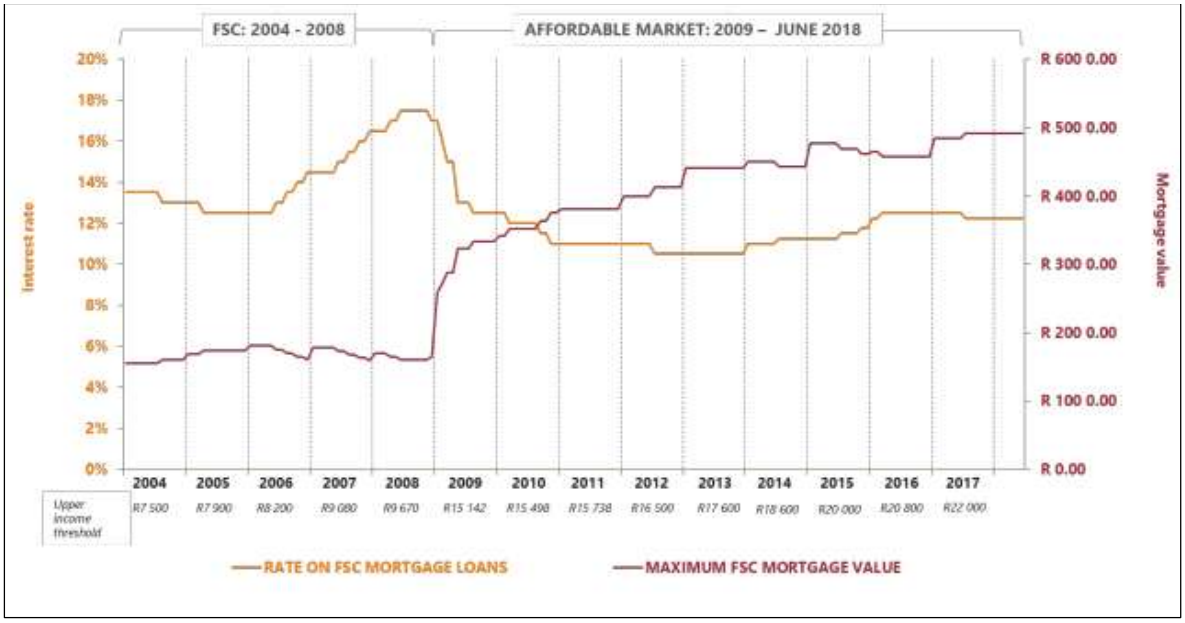


Figure 8: Mortgage affordability to the FSC / Affordable market 2004 – 2018

Source: Meltzer & Hayworth (2018)

The graph above clearly shows that affordability is a moving target. The income affordability is influenced by the rising cost of being able to deliver affordable housing stock as well as the variable interest rate environment (Melzer, 2015).

b) Consumer indebtedness/ creditworthiness

The SA consumer is highly indebted. Household debt to disposable income grew from 73% in 2019 to 77% in 2020 (SARB, 2021).

Melzer (2016) assessed the consumer credit journey from 2008 onwards, showing how consumer priorities have changed evidenced by changes in credit patterns, i.e., consumers are spending more on retail, micro lenders, personal loan and credit card and that the timeframe of taking out a mortgage after the first credit product has significantly decreased. She accredits this to a lack of consumer education on credit and argues that the challenge is less about access to credit than about shifting priorities towards housing.

Banks are required to submit data to the Office of Disclosure on housing loan applications. The data shows relatively low numbers of applications from the GAP / Affordable market (Melzer, 2016). It also indicates relatively low acceptance rates across the market. Across the big four banks, approval rates range from 25% - 40% of all applications received. That means 60% - 75% of all applications are declined. They cited the key reasons for rejections are compromised credit histories and affordability. Poor affordability means they are likely overexposed to other credit and so have little disposable income left for housing credit and unacceptable security/ collateral to make up the shortfall (Melzer, 2016; Melzer & Hayworth, 2018).

Carrim, Fubbs and Wicomb (2017) noted that the decline in the number of credit applications approved was largely impacted by the more stringent affordability assessment criteria introduced by the National Credit Regulator (NCR) in September 2015, which caused fewer consumers to qualify for access to credit.

Data released by the NCR in 2016 show that more than half of all consumers who are credit active are in arrears on one or more credit accounts. This is highlighted in the graph below. The graph also shows significant growth of 40% in the number of consumers accessing credit between 2008 and 2016.

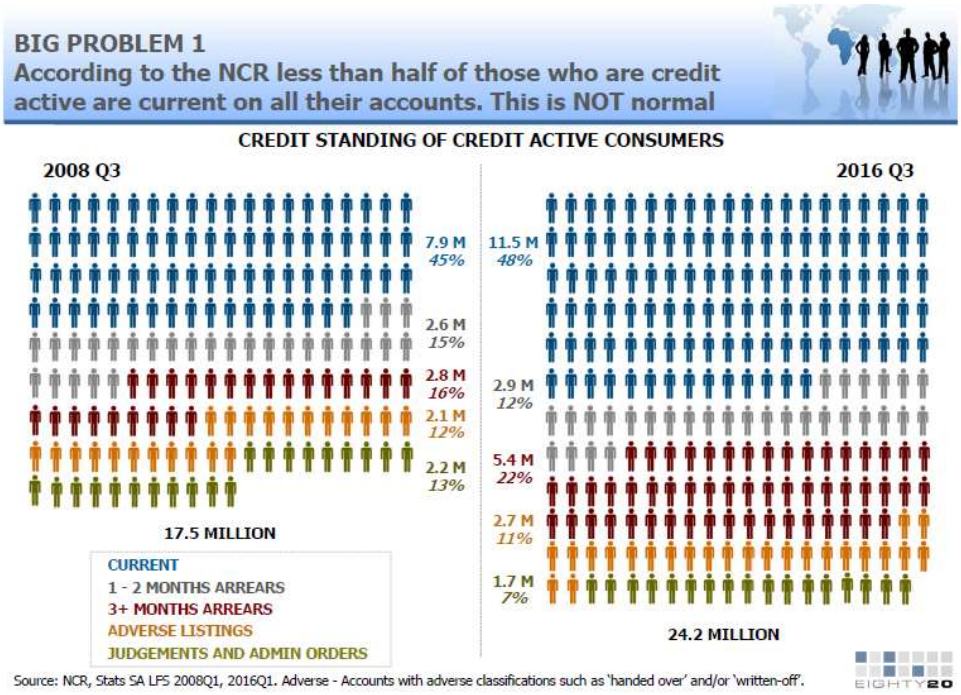


Figure 9: Credit standing of credit active consumers 2008: Q3 vs 2016: Q3

Source: Eighty20

Over-indebtedness is caused by irresponsibility of the individual or family, reckless lending by credit providers or by a change in personal circumstances that cause families to have a financial setback, i.e., death of a loved one, job loss, business troubles, etc.

The above indicates the significant demand and desirability of home ownership, but affordability and access to finance remain the largest constraints.

2.6 Supply side challenges influence on housing demand

Spies (2011) conducted a qualitative study on the supply chain of affordable housing and his findings highlight that affordable housing development projects suffer from long and costly setbacks due to regulatory delays, delays in providing bulk infrastructure, rising building costs and lack of end-user mortgage funding. The delays reported during the township application process can be as much as five years longer than the stipulated regulations (CAHF, 2015). This is in addition to the lengthy delays experienced in every phase of the delivery process (CAHF, 2015; McGaffin, 2018).

CAHF (2015) demonstrated the cost of delays in one housing project, showing a 24-month delay increased development costs by 175%, which resulted in an increase of 124% on the

selling price from the initial budget. The delay escalated the development financing costs by 160% per unit in interest costs, which reduced profitability by 70%, thus impacting the capacity to deliver all the units planned.

Furthermore, developers report that approximately 20% of buyers that put down offers to purchase are declined by mortgage lenders due to adverse credit records and 50% are declined due to affordability constraints, leaving only 30% of applicants being successful in accessing mortgage finance (CAHF, 2015). This is a significant challenge for developers as they plan their pipeline of stock off pre-sales.

As a result, house prices are continuing to rise. McGaffin (2018) saw the main driver of the increase in house prices as this scarcity factor, i.e., there is insufficient supply able to meet demand. Developers are simply not able to meet demand due to the various constraints they face. Figure 10 below shows the gap between housing price inflation and building cost inflation is continuing to increase. In Cape Town alone they estimated a shortfall in 2018 of 320 000 formal housing to cater for the number of households in the province. Considering approximately 1.8% household growth per annum, they estimate a requirement of 30 000 to 40 000 houses per annum compared to supply of 8 000 to 10 000 per annum (McGaffin, 2018).

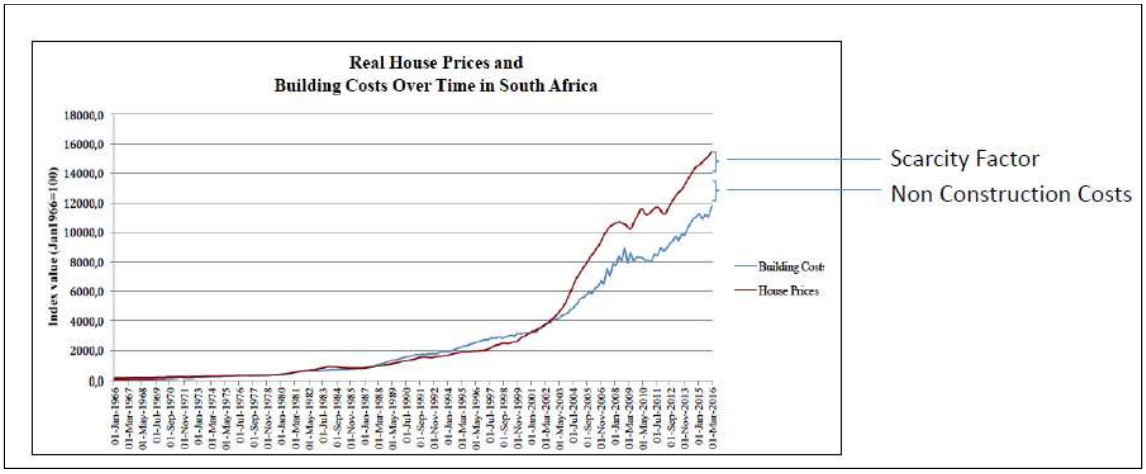


Figure 10: Real house prices and building costs over time in South Africa *Source: Njokweni et al, 2016, cited by McGaffin, 2018*

This, together with escalating building costs, lack of economic growth, job losses and over-indebtedness in the target market, put significant pressure on the returns and viability of greenfields projects, thus limiting investment in this space (CAHF, 2015). As a result of inadequate supply, frustration and inequality will continue to grow.

An untapped opportunity that could significantly stimulate the supply of new properties is the resale market of government sponsored properties (Rust & Tshangana, 2019). The Centre for Affordable Housing Finance extensively advocates for this. One of the criteria of the RDP/ BNG programme is that households are constrained from selling their properties within the first eight years. Figure 11 and 12 below shows that a significant portion of government- sponsored properties (GSP) were older than eight years in 2017. The data was only available in four provinces: Nelson Mandela Bay (NMB), eThekwini, Johannesburg and Cape Town. For the first three provinces, 89%, 95% and 95% of GSP properties are older than eight years. For Cape Town, it was just below 80%. The diagram also shows the amount of GSP properties that have increased in value into the affordable category; 11.6% in NMB, 27.5% in eThekwini and 53.5% in Johannesburg. A small portion of properties have even moved into the conventional market category. Rust and Tshangana (2019) show Cape Town GSP beneficiaries climbing up the wealth ladder. In 2017, 1.7% of GSP older than 8 years were sold at an average price of R337 588, with prices ranging from R150 000 to R580 000, compared to the average value of all GSP older than eight years of R242 149.

This represents a 'low-hanging fruit' opportunity to increase the affordable supply to the market. "Government-subsidised housing creates a new first rung on the housing ladder in Cape Town, offering value to existing owners (and a chance to climb the housing ladder) and affordable housing to aspiring buyers" (Rust & Tshangana, 2019).

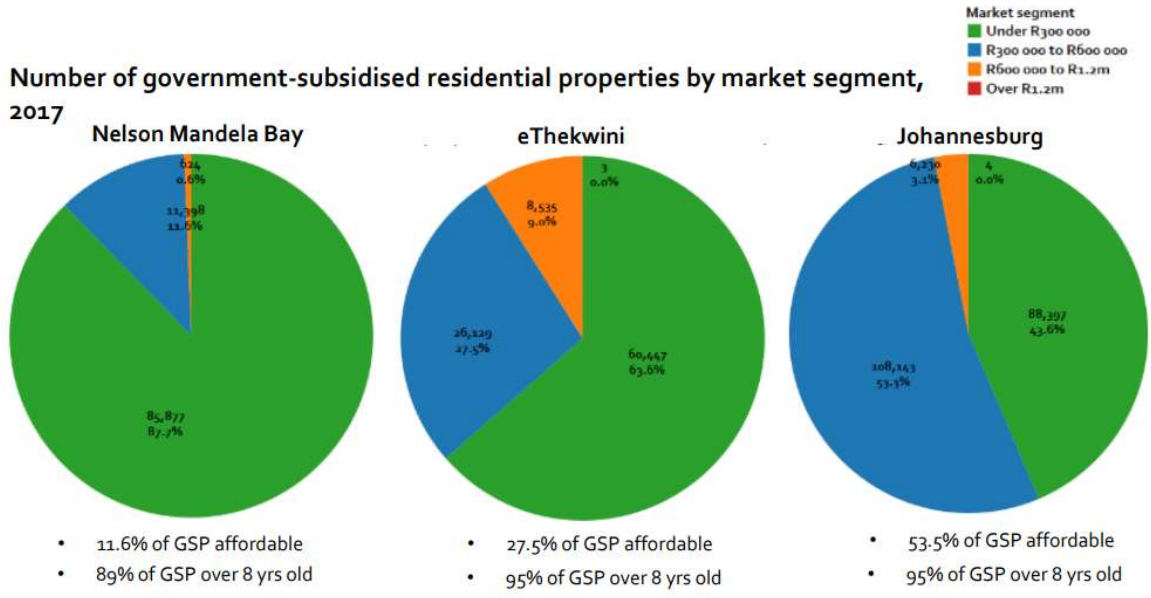


Figure 11: Number of govt subsidised residential properties by market segment

Source: Rust & Shangana, 2019

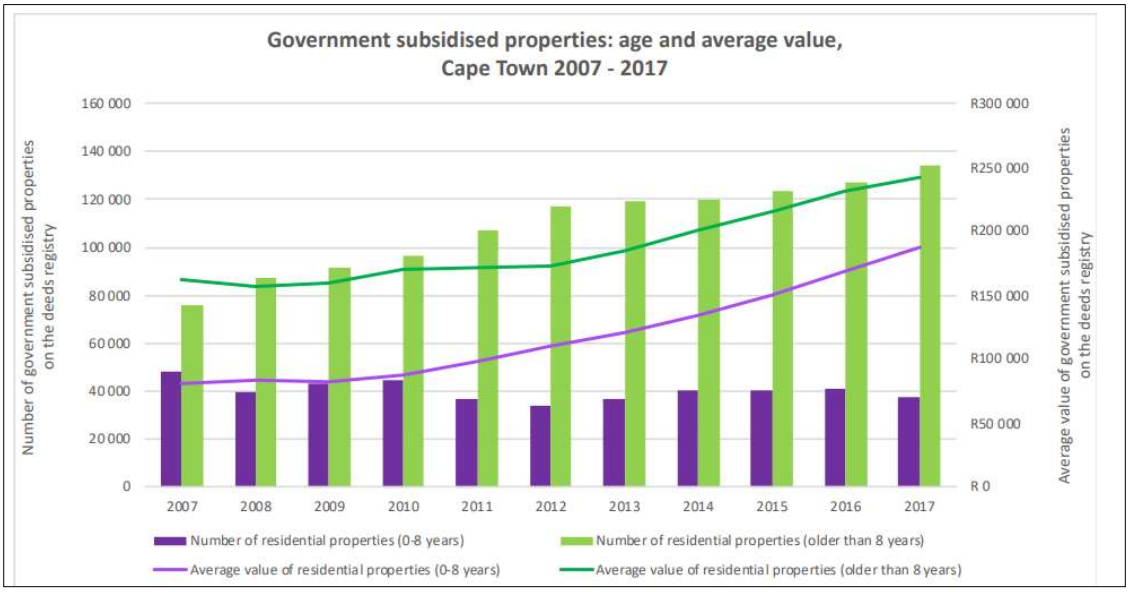


Figure 12: Government subsidised properties in Cape Town, 2007-2017 *Source: Rust & Shangana, 2019*

2.7 Government policies influence on housing demand

"Everyone has the right to have access to adequate housing. The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of this right." – Section 26 of the Constitution of South Africa

The Department of Human Settlements (DHS) is tasked with the mission to fulfil the constitutional mandate by "facilitating the creation of sustainable human settlements and improved quality of household life" (Department of Human Settlements, 2020). "The Housing Act, Act 108 of 1996 states that the DHS should establish and maintain habitable, stable and sustainable public and private residential environments to ensure viable households and communities in areas, with convenient access to economic opportunities, and to health, educational and social amenities" (Department of Human Settlements, 2020). The DHS, furthermore, consults and collaborates with all stakeholders in the housing value chain, including, the private sector and civil society to fulfil its mission. In alignment with the NDP goal, a key objective is "to ensure that property can be accessed by all as an asset for wealth creation and empowerment" (Department of Human Settlements, 2020).

The Housing Act prescribes the roles across various government departments mandated with housing delivery. The National Housing Code sets the policies which govern the various national housing programmes. The National Urban Reconstruction and Housing Agency

(NURCHA), the Rural Housing Loan Fund (RHLF) and the National Housing Finance Corporation (NHFC) are the government agencies tasked with providing housing finance towards the key programmes designed for the different market segments.

In 2017, the minister of Human Settlements, Lindiwe Sisulu, announced the government's plans to consolidate these entities into one to form the Human Settlements Development Bank (HSDB) to enable greater efficiencies in advancing development finance across the housing value chain and thus improve the speed of delivery ('Treasury gives nod for Human Settlements Development Bank', 2020). In the 2019 State of the Nation address, President Cyril Ramaphosa announced a target to deliver 500 000 houses by 2024. The consolidation of the entities was finalised in October 2018; however, the HSDB bill is still in the process of being finalised (Department of Human Settlements, 2019).

The following are the current active government programmes to support housing finance and housing provision.

a) Breaking New Ground / RDP

Government has made significant progress in the last 27 years since the start of democracy in delivering housing to the poorest households in the country. The Reconstruction and Development Programme (RDP) 1994 for households earning below R3500, qualified for a fully subsidised house and prioritised the elderly and those households with dependents. Since 1994, government facilitated the provision of approximately 4.8 million housing opportunities through its RDP programme, i.e., c25% of households (Department of Human Settlements, 2020). Despite this incredible achievement, the housing backlog remains at 2-3 million housing units, almost doubling from 1995, when it was reported to be 1.5 million units (Muhuro, 2015). This is due to urban migration into cities as people move into the cities in search of work and a better life (Turok, 2020). As a result, the number of informal settlements has grown from 300 to over 3000 over the last 10 years (Department of Human Settlements, 2020).

There has been much criticism regarding the sustainability of government continuing to provide fully subsidised housing to households. The government fiscus simply cannot afford to fulfil the required demand. The Housing White Paper of 1995 acknowledges this constraint and estimated a cost of over R300 billion to eliminate the housing backlog (Muhuro, 2015). In addition, there has been a multitude of negative consequences such as corruption, beneficiaries

front running others who have been in the system for a much longer time, a culture of entitlement among lower income households whereby households avoid declaring income or moving up the wealth ladder in order to be eligible for a free house (Melzer & Hayworth, 2018; Muhoro, 2015). The minister has also reported that many beneficiaries have ended up selling their units for significantly below market value (Sisulu, 2014). In this instance, beneficiaries have evidently not been educated around the value of a house. Many beneficiaries also choose to rent out their units and continue to live in the informal settlements to earn money (Sisulu, 2014). This is another contributing factor to the increase in informal settlements.

Muhoro (2015) proposes that government should rather become an enabler rather than a deliverer of housing noting that the continued delivery of RDP is unsustainable as the fiscus cannot afford it.

b) Serviced sites

Government acknowledges that the fully subsidised housing plan is unsustainable, thus they have found alternative innovative ways to provide access to housing. Government will instead provide serviced sites, on which people can construct their own homes. Fully subsidised homes will be exclusively for elderly people, military veterans, people living with disabilities and child-headed households (Thukwana, 2020).

c) Finance-linked Individual Subsidy Programme (FLISP)

In 2012 the government legislated the Finance-Linked Individual Subsidy (FLISP) to support those households who earn too much to access fully subsidised housing and too little to access a bank home loan earning. These households are defined as the GAP market. Though this was a great initiative, it has had very little success to date. The Department of Human Settlements, (DHS) in the 2014-2019 Medium-Term Strategic Framework (MTSF), had a target of delivering 70 000 FLISP subsidies to qualifying beneficiaries; however, between 2014 -2018 only 8 400 subsidies were dispersed (Department of Human Settlements, 2019). The main problem was rising building cost inflation and no adjustment in FLISP income targets. Further, constraints around the administration of FLISP have also presented significant challenges.

The FLISP was revised in July 2018. Changes include an increase in the upper income threshold from R15 000 to R22 000 as well as an increase in the quantum of the subsidy amount across income bands. The subsidy is allocated on a sliding scale, with individuals/households earning between R3 501 and R3 700 per month being able to access a subsidy amount of R121 626

(previously R87 000), while those earning between R21 801 and R22 000 can access a subsidy amount of R27 960 (previously zero).

The changes are expected to improve affordability for a greater number of households, yet those earning below R13k, even with the subsidy, still cannot afford the cheapest product on the market (Venter, 2019). i.e., housing policy excludes a large proportion of the GAP market from access to home ownership (Muhuro, 2015).

d) Pension-backed housing loans (PBHL)

Members of specific pension funds can use their pension fund savings as collateral/security for a bank loan to be used towards housing finance, i.e. purchasing a house or vacant stand, renovations, deposit toward a new home loan and legal fees. This is an alternative way for employers to assist staff towards the goal of home ownership. Funding is cheaper than a bank loan and no bond registration costs are payable. PBHL are governed by section 19 (5) of the Pension Funds Act and is the only other permissible use of pension funds (Meyer, 2021).

e) The Government Employees Housing Scheme (GEHS)

Government launched the GEHS in 2015 for public sector employees to enable greater access to home ownership to ensure a more stable and secure workforce. More than 1 million employees were eligible for the housing allowance. Eligible employees receive a monthly housing allowance of R1 276 toward housing provision, either toward a home loan or toward a rental property. If an employee is renting, a portion of the subsidy is allocated to a GEHS Individual-linked savings facility (ILSF) to save for future home ownership. The GEHS has partnered with SA Home Loans to provide mortgage loans to government employees. The ILSF is managed by the National Treasury and earns interest. Public sector employees are able to access the GEHS in addition to FLISP if they qualify (SA Homeloans, n.d.).

f) Integrated residential development programme

The integrated residential development programme requires new residential developments to allocate a portion of serviced sites for households earning above R3 500. Households are required to build their own home and to raise the finance to do so.

g) South African monetary policy

The South African Reserve Bank (SARB) is mandated to ensure the economic well-being of South Africans through achieving and maintaining price stability and protecting and enhancing financial stability. The SARB controls inflation through its monetary policy regime and thereby fulfils its primary constitutional mandate, "which is to protect the value of the currency in the interest of balanced and sustainable economic growth" (SARB, 2020). The SARB implements monetary policy by influencing interest rates as the primary tool to ensure inflation is maintained within the 3%-6% target range, with the aim of targeting the midpoint of this range (SARB, 2020). The SARB generally increases the repo rate when inflation is too high to curb excessive spending and asset price movements and lowers interest rates when inflation is low to stimulate spending and growth. Lending institutions adjust lending rates in line with the SARB's change to the repo rate, which is the short-term overnight interest rate that the SARB lends to banks. These decisions are made "in the interest of balanced and sustainable economic growth" (SARB, 2020). The SARB (2020) states that "a monetary policy stance that provides a low and stable inflation environment protects the purchasing power of all South Africans, particularly the poor, and supports economic growth and contributes to South Africa's ability to create employment".

Fuchs (2018) states that "monetary stability is fundamental to building mortgage markets. Generally, high inflation is a reflection of macroeconomic instability and is associated with high policy interest rates and shallow mortgage markets. Policy interest rates tend to be lower in countries with greater monetary stability." He also points out the need for governments to maintain financial stability as mortgages are long term instruments and thus shocks to the system can greatly affect financial stability and the life of mortgage markets.

2.8 Empirical research

The empirical studies evaluating factors influencing the supply of mortgage loans across different countries and geographic markets have investigated the relationships between macroeconomic variables and the supply of mortgage loans or mortgage market growth. These factors range from inflation, interest rates, economic growth (GDP), house price growth, exchange rate, etc. These factors are important to understand as they support an enabling environment for the provision of mortgage finance.

Warnock and Warnock (2008) examined the impact of the macroeconomic environment on the provision of mortgage loans across a wide range of countries. The study found that countries with strong legal rights for both lender and borrower, strong borrower credit information systems and a stable macroeconomic environment have deep mortgage finance markets. This section summarises the literature explored.

a) Inflation and Interest rates

Numerous empirical studies found that mortgage supply is negatively correlated to interest rates and inflation, i.e., an increase in interest rates or inflation results in a decrease in housing demand and consequently mortgage supply. Most mortgages are variable rate mortgages, and the monthly repayment increases as interest rates increase, thereby utilising a greater portion of disposable income and thus making it less affordable. Inflation influences the purchasing power of consumers and so higher inflation will lessen purchasing power, thus lowering affordability.

Chipswa (2017) demonstrated that there is a negative correlation between interest rates and mortgage supply and inflation and mortgage supply in South Africa using a multi-linear regression model over a 20-year period from 1995 to 2015. Furthermore, the relationships were found to be statistically significant. However, the regression analysis showed that mortgage supply was most affected when inflation and interest rate moved in the opposite directions, i.e., declining interest rates incentivises consumers to borrow and spend, having a lagged effect on price increases and thus inflation, resulting in a decrease in housing demand (mortgage supply) and vice versa. The aim of the research was to demonstrate the critical role the central bank plays in affecting housing demand / mortgage supply in South Africa through monetary policy.

Conversely and Ayenew (2019) found that there is a positive and significant relationship between interest rates and mortgage market growth in Ethiopia. Ayenew (2019) states that commercial banks profitability is derived from interest rate charges on loans thus if interest rates increase then banks willingness to advance mortgages also increases as profitability increases. Ayenew (2019) found a negative and insignificant long-term relationship between inflation and mortgage market growth.

Anastasia and Diyanto (2018) did a similar study in Indonesia using an Auto Regressive Distributed Lag (ARDL) cointegration model to test the relationship between macroeconomic variables and the proportion of housing mortgage loans over the period 2005 to 2016. The study

found a significant and negative long-term relationship between inflation and the proportion of housing mortgages, but no statistically significant relationship was found between interest rates and housing mortgage proportion. The author revealed that research used the variable interest rate from Bank Indonesia, which does not have a direct relation with the determination of credit interest of each bank, citing this as a limitation of the research.

Contrary to other studies, Painter and Redfearn (2002) found that interest rates showed little influence in changing homeownership rates in the USA, i.e., no long-term relationship could be proven. However, the study found housing starts (housing supply) to be highly sensitive to interest rate changes as developers will need to access development finance to construct the houses.

Housing is a significant contributor to a well-functioning and healthy economy. Central banks have a critical role to play in ensuring that interest rates and inflation are kept stable for a well-functioning mortgage market.

This study seeks to demonstrate the effect of these factors on different segments of the market categorised by household income. It is expected that the lower income market is likely to be more sensitive to interest rate or inflation rate changes than the higher income markets. Thus, it can be argued that monetary policy alone cannot influence housing demand at the lower end, who need specific policy intervention, as discussed by Limba (2019) and Muhuro (2015).

b) Gross Domestic Product (GDP)

Filotto, Giannotti, Mattarocci and Scimone (2018) analysed the impact of GDP growth on mortgage lending across 16 different European countries over the period 2007 to 2015 using a Vector Autoregressive (VAR) and generalised VAR approach as well as impulse response analysis to test the long-term impact of shocks of one variable on another. The study found that over the long term, shocks to GDP had a positive effect on the number of mortgages advanced. The strength of the relationship varied across countries with their own specific nuances and the impact of shocks to GDP in one EU country influenced GDP and mortgages in majority of the other EU countries, evidencing the interdependence between countries. Similarly, the Indonesian study by Anastasia and Diyanto (2018) also found a significant and positive long-term relationship between GDP and the proportion of housing mortgages.

Conversely, Owuor (2017) found that there is an insignificant relationship between GDP and the mortgage market growth in Kenya. Ayenew (2019) also found an insignificant relationship between GDP and Ethiopian banks' loan and advances, however with positive correlation. The residential mortgage market comprises a significant component of GDP in most countries thus empirical evidence demonstrating the relationship between mortgages and the economy can greatly assist policy makers in monetary and economic policies.

c) House Prices

Anastasia and Diyanto (2018) found a significant long-term relationship between property price and the proportion of housing mortgages in the Indonesian market with a negative correlation. Rising house prices influence consumer affordability as the amount of disposable income for housing purchase declines, thus consumers are likely to postpone such investment. Similarly, when housing prices fall, affordability improves and an increase in demand for housing and consequently mortgage loans has been found. The study done by Filotto, Giannotti, Mattarocci and Scimone (2018) on the EU market also found that over the long term, a shock to the house price index (HPI) had a negative effect on the number of mortgages advanced.

Brissimis and Vlassopoulos (2009) and McQuinn (2021) also investigated the relationship between mortgage financing and housing prices in Greece and Ireland respectively. Conversely, they found a positive and significant long-term relationship between house prices and mortgage advances. Brissimis and Vlassopoulos (2009) demonstrated that higher property prices improved consumer wealth via increased home equity thus increasing borrowing capacity and therefore demand for credit. Banks, in turn, met the increased demand with mortgage supply. Gerlach and Peng (2005) as cited by Brissimis and Vlassopoulos (2009) also highlighted increased property valuations on the books of banks, will increase the availability of credit and therefore increase demand for mortgage finance.

d) Other factors influencing mortgage supply

Empirical studies also investigated other factors such as the exchange rate, household debt, tax incentives, cost of capital, land registration systems, amongst other factors. Mortgage supply was also found to be positively correlated to the foreign exchange rate, i.e., an increase in the exchange rate results in decreased housing demand (mortgage supply) (Chipswa, 2017).

Ngugi and Njori (2013) demonstrated that tax incentives, cost of capital, land registration systems and loan maturation period showed strong and positive relationship with access to mortgage finance in Kenya. The study recommended that mortgage finance providers offer potential home buyers' incentives to assist them with access to mortgage finance. Similarly, Ling and McGill (1998) also found that the rate of tax savings on mortgage interest deductions significantly affected mortgage finance using data from the American Housing Survey. This study also analysed loan sizes with value of houses and level of household income, finding that larger loan sizes are strongly related to higher value housing as expected, and similarly higher income was also positively related to higher loan sizes.

The study by Mintah and Eric (2014) assessed the impact of Savings, Land Disputes and Place of Housing as predictor variables on accessing housing through mortgage finance. The study found that all variables had a strong influence on mortgage demand; however, Savings and Land Disputes were positively correlated while Place of Housing was negatively correlated with mortgage demand. However, other challenges such as the terms of repayment, deposit requirements, documentation requirements, ability to pay and income hindered consumers' ability to access mortgage finance.

2.9 Conclusion

Research on the factors influencing mortgage supply in the developing world including South Africa is limited. The majority of research in this area has been conducted on the developed world (Chipswa, 2017). Chipswa (2017) conducts this analysis for South Africa but for the market as a whole. This study will go beyond this generality as it will seek to assess the factors influencing mortgage supply across different market segments categorised by household income and/or loan sizes. This is particularly important in South Africa's context as its population dynamics vary significantly being one of the most unequal societies in the world (Orthofer, 2016). The goal is to assist policy makers in understanding the factors influencing mortgage supply or housing demand and to avoid setting brilliantly designed policies in isolation, which become ineffective as market factors shift. Housing policy must be flexible and must adjust with market forces to continue to be effective to assist in the goal of economic redistribution.

Chapter 3

Methodology

3.1 Introduction

This study seeks to investigate the empirical relationships between interest rates, inflation, GDP and house prices on mortgage supply as measured by mortgages advances over the period 2007 to 2020. This section describes the research methodology that was undertaken to answer the research questions. It describes the research approach and strategy, the data sources and collection methods, the research design, data analysis and limitations to the methodology.

3.2 Research approach and strategy

The study uses a quantitative strategy and deductive reasoning approach to examine the influence of interest rates, inflation, GDP and house prices on mortgage supply across different household income segments and loan sizes. The study is also exploratory in nature as it seeks to examine the empirical relationships between the variables. The researcher has sufficient reliable data to conduct a quantitative study.

3.3 Data sources and data collection

Quantitative data in this study was collected from South African Reserve Bank (SARB) and National Credit Regulator (NCR) over the period 2007 and 2020. The data is quarterly data collected from 2007: Q4 to 2020:Q4. All the data was sourced online from the SARB and NCR websites.

3.4 Regression equation

A multiple-linear regression model will be utilised to examine relationship and strength of relationship of the factors (independent variables) relative to successful mortgage loans advanced to low-, middle- and high-income households (rand and number) and small, medium and high mortgage loan sizes (rand & number) (dependent variables). The data is expected to explain how and to what extent these factors influence mortgage supply across various market

segments. Following Warnock and Warnock (2008) and Anastasia and Diyanto (2018), the regression equation employed to examine the determinants of mortgage supply is defined as:

$$ms_t = \beta_0 + \beta_1 ir_t + \beta_2 \in f_t + \beta_3 gdp_t + \beta_4 hpi_t + \varepsilon_t$$

where ms_t denotes mortgage supply in period t; ir_t, f_t, gdp_t and hp_t represent interest rate, inflation rate, gdp and house price index in time t respectively and ε is the error variable.

3.5 Definition and measurement of variables

This section outlines the definition and measurement of the variables and summarises the expected relationships in line with the empirical studies investigated.

3.5.1 Dependent variables

The dependent variable, mortgage supply, is measured by the total mortgages, in rand value and number, advanced by mortgage finance providers to individuals. The NCR reports on total mortgages advanced to households across different income categories and across different loan sizes. The definition of mortgage advances according to the SARB - "Mortgage loan or advance means any loan or advance granted by the reporting bank to a person, which loan or advance is repaid by the obligor in whole or in part in instalments during a specified period in the future and in terms of which loan or advance a mortgage bond in respect of a specified property is registered in favour of the reporting bank, and which mortgage bond serves as collateral in respect of the loan or advance to be repaid by the obligor during the said specified period in the future."

The following data were sourced to model mortgage supply in rand value and volume across various market segments categorised by household income and loan sizes. In this study, mortgage supply is proxied as rand value of mortgages granted, and the number of mortgage applications granted.

In addition, the rand value of mortgages granted across household income is also classified into three categories as follows:

a) Rand value of mortgages granted for low income (R0-R7500),
b) Rand value of mortgages granted for middle income (R7501-R15000)
c) Rand value of mortgages granted for high income (>R15000)

The number of mortgage applications granted across household income is also classified into three categories as follows:

a) Number of mortgages granted for low income (R0-R7500)
b) Number of mortgages granted for middle income (R7501-R15000)
c) Number of mortgages granted for high income (>R15000)

The rand value of mortgages granted across loan size is also classified into three categories as follows:

a) Rand value of mortgages granted for small mortgages (R0-R350K)
b) Rand value of mortgages granted for medium mortgages (R351k-R700K)
c) Rand value of mortgages granted for large mortgages (>R700K)

The number of mortgage applications granted across loan size is also classified into three categories as follows:

a) Number of mortgages granted for small mortgages (R0-R350K)
b) Number of mortgages granted for medium mortgages (R351k-R700K)
c) Number of mortgages granted for large mortgages (>R700K)

To assess the impact of macroeconomic variables on mortgage supply across household income market segments, the proportion of mortgage loans advanced to low-, middle- and high-income in rand value and number as well as the proportion of mortgage loans advanced in respect of small, medium and high loan sizes in rand value and number were assessed.

3.5.2 Independent variables

Similar to prior empirical studies, this research used the following macroeconomic variables as the factors which are expected to influence mortgage supply.

a. Interest Rates

The repo rate is the short-term overnight interest rate that commercial banks borrow money from the SARB. The prime lending rate is the base rate at which banks/mortgage lending institutions lend to consumers, adjusted for the level of risk of the consumer. The prime rate trades at 3.5% above the repo rate, which is the banks base profit margin (SARB). Following Chipswa (2017), this study uses the prime interest rate as a proxy to measure the impact of interest rate changes on mortgage supply.

Rising interest rates are expected to have a negative effect on mortgage supply as rising debt servicing costs lowers discretionary income thus lowering affordability for mortgage finance. Rising interest rates are expected to affect the lower income market segment to a greater extent as this market segment has less disposable income. Rising interest rates also increase default risk which may lower lending institutions' risk appetite for advancing mortgage finance, especially to the lower income market segment. Contrarily, low interest rates are expected to positively affect mortgage supply as affordability is likely to improve as a result.

b. Inflation

Inflation refers to the increase in the general price level of goods and services in an economy (SARB). This study uses the Consumer Price Index (CPI) which represent the typical basket of goods and services used by South African households. It is expected that an increase in inflation will have a negative impact on mortgage supply as it causes a decrease in the purchasing power of consumers, thus having less affordability for mortgage loans. A high inflation environment is also negative for lending institutions risk appetite as default risk increases. On the contrary, a low and stable inflation environment is positive for mortgage lending.

c. GDP

The gross domestic product (GDP) is the total value of all goods and services produced within an economy less the value needed to produce them. GDP is one of the main indicators used to measure economic production and growth. The study uses the growth rate of real GDP (non-seasonally adjusted), measured quarterly. A positive and strong economic growth rate is expected to have a positive effect on mortgage supply, as consumers have a positive expectation about the future and demand for housing is expected to increase and equally banks are more willing to lend in a strong growth environment. The opposite is true: when economic growth is weak, consumers are less confident about the future and demand for mortgages is expected to decline and banks are more risk-averse in a weak-growth economic environment.

d. Real House Price Index

Real house prices refer to nominal house prices deflated by inflation, i.e., the consumer price index. The SARB collates the data from the BIS, FNB, ABSA, Stats SA as published in the SARB's Financial Stability Review 2020 Annual Report. The FNB Property Barometer Newsletter defines the FNB House Price Index as a national house price index which uses the repeat sales approach by "measuring the rate of change in the prices of individual houses

between two points in time, based on when the individual homes are transacted. The various price inflation rates of individual homes are then utilized to compile the average price inflation rate of the index over time. The maximum price cut-off is R15m, and the lower price cut-off is R20 000" (Mkhwanazi, 2021). Absa's House Price Index is based on the total purchase price of $80m^2$ – $400m^2$ houses and below a particular value (including improvements), for which loans were approved by Absa (Du Toit, 2009).

The table below summarises the variables and their measurement as described above.

Table 5: Description of dependent and independent variables

Variable	Indicator	Source
Dependent Variable		
1. Mortgage Supply (Household Income)	1.1 Proportion (%) of mortgages in total rand value advanced across low-, middle- and high-income households	NCR
	1.2 Proportion (%) of mortgages in volume advanced across low-, middle- and high-income households	NCR
2. Mortgage Supply (Loan Size)	2.1 Proportion (%) of mortgages in total rand value advanced across small, medium and large loan sizes	NCR
	2.2 Proportion (%) of mortgages in volume advanced across small, medium and large loan sizes	NCR
Independent Variables		
Interest rate (ir)	Prime lending rate (%)	SARB
Inflation (inf)	Headline Consumer Price Index (CPI) (%)	SARB
Gross Domestic Product (gdp)	Real GDP growth non-seasonally adjusted (%)	SARB
House Price Index (hpi)	Real house price index growth (%)	SARB

3.6 Estimation Approach

The study uses time series regression analysis to test the relationship between the macroeconomic variables, house prices and mortgage supply across different household segments and loan sizes, adopting a multiple linear regression technique.

a) Unit root test

Unit root tests are applied to time series data to test for stationarity in each of the variables (Zivot &Wang, 2003). Time series data has stationarity if it has a constant mean and variance over time, i.e., the shape of the distribution does not change over time. The presence of unit roots indicates the data is non-stationary, i.e., the mean and variance changes over time (Zivot

& Wang, 2003). Performing regression analysis with non-stationary data can lead to spurious and unreliable regression results (Iordanova, n.d.).

According to Zivot and Wang (2003), many economic and financial time series data exhibits non-stationary behaviour and a trend removal technique will be required to transform the data to stationarity. There are two trend removal techniques: first differencing, and time trend regression (Zivot & Wang, 2003). These techniques can be used to make non-stationary data stationary. Y_t is integrated of order 1, I(1), as it has to be differenced once, i.e. Y_t-Y_{t-1}, to get a stationary time series (Zivot & Wang, 2003). A time series can be differenced d times (I(d)) to get a stationary series. A time series of integrated to order 0, i.e. I(0), is considered to be stationary.

The Augmented Dickey Fuller (ADF) test was utilised to test for the presence of unit roots. The ADF test is a modification of the original Dickey Fuller test correcting for serial correlation in the error terms by integrating lagged terms of the dependent variables (Gujarati, 2003). To determine the optimal lag length, the Akaike Information Criterion (AIC) was used. Other commonly used tests to test for unit roots are the Durbin-Watson, Philips-Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin. The PP test was applied as a secondary test to verify the results of the ADF test.

The ADF test is based on testing the null hypothesis that the data is non-stationary i.e., H0: $\delta = 0$ against the alternative hypothesis that the data is stationary, i.e., H1: $\delta < 0$. If the null hypothesis is rejected, the data is stationary.

b) Cointegration test

A cointegration test is performed to test the existence of a long-term relationship between the variables in the study (Gujarati, 2003). The Autoregressive Distributed Lag (ARDL) test was selected to test for cointegration as the methodology can be applied to data of any order of integration and can easily be used to derive the Error Correction Model (ECM). If the variables are cointegrated, then there exists a long-term relationship between the variables and the variables will move closer together over time, toward a long-run equilibrium relationship (Zivot & Wang, 2003).

Cointegration is common amongst variables in economics and finance theory where long run equilibrium relationships are known to exist, for instance, between consumption and income; money, income, prices and interest rates; inflation and interest rates. Short-run deviations from equilibrium occur, but economic forces will tend to restore long-term equilibrium relationships (Zivot & Wang, 2003). If the data is non-stationary (I(1)) and not cointegrated, then the results are likely to be spurious.

The ARDL model was used to assess long-run and short-term cointegration between mortgage supply and interest rates, inflation, GDP and house prices respectively. The model is given by the following equation:

The model is shown in the formula below.

$$\Delta ms_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta ms_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta ir_{t-1} + \sum_{i=0}^{n} \beta_{3i} \Delta inf_{t-1} + \sum_{i=0}^{n} \beta_{4i} \Delta gdp_{t-1} + \sum_{i=0}^{n} \beta_{5i} \Delta hpi_{t-1} + \beta_{6i} ms_{t-1} + \beta_{7i} ir_{t-1} + \beta_{8i} inf_{t-1} + \beta_{9i} gdp_{t-1} + \beta_{10}\ hpi_{t-1} + \varepsilon_t$$

The ARDL model tests the following hypothesis:
H0: $\beta_{6i} = \beta_{7i} = \beta_{8i} = \beta_{9i} = \beta_{10i} = 0$ (cointegration does not exist)
H1: $\beta_{6i} \neq \beta_{7i} \neq \beta_{8i} \neq \beta_{9i} \neq \beta_{10i} \neq 0$ (cointegration exists)

c) Long-run and short-run equations

Cointegration implies the existence of an error correction model (ECM) as demonstrated by Engle and Granger. The ECM was derived from the ARDL Model. The ECM is able to capture both short and long run relationships by linking the long-run equilibrium relationship with the short-run dynamics reflecting deviations from the long-run equilibrium. (Zivot & Wang, 2003)

The relationships are captured using the following equations:

Long-run

$$ms_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} ms_{t-1} + \sum_{i=0}^{n} \beta_{2i} ir_{t-1} + \sum_{i=0}^{n} \beta_{3i} inf_{t-1} + \sum_{i=0}^{n} \beta_{4i} gdp_{t-1} + \sum_{i=0}^{n} \beta_{5i} hpi_{t-1} + \varepsilon_t$$

Short run

$$ms_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta ms_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta ir_{t-1} + \sum_{i=0}^{n} \beta_{3i} \Delta inf_{t-1} + \sum_{i=0}^{n} \beta_{4i} \Delta gdp_{t-1} + \sum_{i=0}^{n} \beta_{5i} \Delta hpi_{t-1} + \beta_6 ECT_{t-1} + \varepsilon_t$$

The Error Correction Term (ECT) captures both the short-run dynamics and long-run relationships as described above. The coefficient β_6 of the ECT indicates how quickly the model reverts back to equilibrium following any deviations away from the equilibrium.

3.7 Conclusion

This chapter explained the research methodology that was employed in this study. The data, frequency of data and sources of data of all the variable were described. The regression model highlighting the dependent and independent variables was outlined. A description of the dependent variables and their measurement was summarised. The estimation technique as well as tests for stationarity and cointegration were described. The results of the model and the research findings are presented in the following chapter.

Chapter 4

Research Findings, Analysis and Discussion

4.1 Introduction

This chapter presents the findings of the research and discusses the results of the models employed in the empirical analysis of the relationship between interest rates, inflation, GDP and house prices on mortgage supply. This chapter is divided into six sections, namely: descriptive statistics, correlation analysis, unit root tests, cointegration test, and the long- and short-run estimates as presented by the error correction model. The last section presents a summary of the chapter.

4.2 Descriptive statistics

The tables below present the summary statistics for all the variables employed in the study separated by dependent and independent variables.

a) Dependent variables

4.2.a.1 Mortgage supply (Household Income)

Table 6 shows the summary statistics for the dependent variables being the proportion of mortgage supply (in rand value and volume) across different household income market segments (low-, middle- and high-income).

Table 6: Descriptive Statistics Dependent Variables (Mortgage Supply:Household Income) Q4:2007-Q4:2020

	MS (Rand Value)			***MS (Volume)***		
Variables	***rv_low***	***rv_mid***	***rv_high***	***vol_low***	***vol_mid***	***vol_high***
Mean	0.003388	0.038318	0.958294	0.012592	0.096710	0.890698
Median	0.001665	0.031761	0.966924	0.005876	0.083884	0.910146
Maximum	0.011335	0.082932	0.993911	0.050940	0.200168	0.984940
Minimum	0.000210	0.004635	0.906204	0.000862	0.011821	0.748892
Std. Dev.	0.003091	0.025244	0.027695	0.013611	0.060948	0.072468
Skewness	1.341306	0.161692	-0.247551	1.518705	0.109709	-0.290347
Kurtosis	3.511868	1.502391	1.562604	4.183362	1.491749	1.671510
Observations	53	53	53	53	53	53

Note: rv_low = Proportion (%) of mortgages in total rand value granted to low-income; rv_mid = Proportion (%) of mortgages in total rand value granted to middle-income; rv_high = Proportion (%) of mortgages in total rand value granted to high-income; vol_low = Proportion (%) of mortgages in volume granted to low-income; vol_mid = Proportion (%) of mortgages in volume granted to middle-income; vol_high = Proportion (%) of mortgages in volume granted to high-income. Source: Candidates estimates from research data.

The results highlight the average proportion of quarterly mortgage loans in total rand value advanced to the low-income market segment was approximately 0.34%, 3.83% to the middle-income and 95.83% to the high-income market segment over the 13-year period. Similarly, the standard deviation across household income market segments was 0.31%, 2.52% and 2.77% across low-, middle- and high-income market respectively, reflecting low variation around the mean for each market segment over the period.

In terms of volume, the average proportion of mortgages advanced to the low-income market segment was 1.26%, 9.67% to the middle-income and 89.07% to the high-income market segment respectively. The standard deviation across market segments was 1.36%, 6.09%, 7.25% reflecting higher variability in the number of mortgages advanced to the middle- and high-income market segments.

The kurtosis coefficients above 3 for the proportion of mortgages advanced to the low-income market segment (in rand value and volume), as well as positive skewness, indicate a peaked distribution positively skewed toward the right.

The kurtosis coefficients below 3 for the proportion of mortgages advanced to the middle-and high-income market segment (in rand value and volume) indicates a flatter distribution with the distribution of the proportion of mortgages to the middle-income positively skewed toward the right and the distribution of high-income negatively skewed to the left. The variables in Table 6 can also be visualised from the graphical display in Figure 13.

4.2.a.2 Mortgage supply (Loan size)

Table 7 shows the summary statistics for the dependent variables being the proportion of mortgage supply (in rand value and volume) across loan sizes (small, medium and large). The table highlights the average quarterly proportion of mortgages advanced across small, medium and large loan sizes (in rand value) was approximately 7.74%, 20.96% and 71.30% respectively over the period. Similarly, the standard deviation across small, medium and large loan size segments was 4.61%, 4.78% and 9.3% respectively.

Table 7: Descriptive Statistics Dependent Variables (Mortgage Supply: Loan Size) Q4:2007-Q4:2020

	MS (Rand Value)			***MS (Volume)***		
Variables	***rv_sml***	***rv_med***	***rv_lrg***	***vol_sml***	***vol_med***	***vol_lrg***
Mean	0.077368	0.209597	0.713035	0.291840	0.306539	0.401621
Median	0.058578	0.204471	0.739845	0.251551	0.310558	0.423734
Maximum	0.167174	0.289379	0.863448	0.503821	0.337012	0.639678
Minimum	0.020249	0.116264	0.543447	0.108030	0.244717	0.202959
Std. Dev.	0.046142	0.047751	0.092999	0.123850	0.020972	0.125520
Skewness	0.644885	0.051620	-0.362953	0.439660	-0.675901	-0.065147
Kurtosis	2.030392	1.878672	1.887020	1.816078	2.966227	1.838813
Observations	53	53	53	53	53	53

Note: rv_sml = Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med = Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg = Proportion (%) of mortgages in total rand value granted for large size mortgages; vol_sml = Proportion (%) of mortgages in volume granted for small mortgages; vol_med = Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg = Proportion (%) of mortgages in volume granted for large mortgages.

In terms of volume, the average quarterly proportion of small sized mortgages advanced was 29.18%, 30.65% for medium size loans and 40.16% for large size loans. Interestingly, the proportion of small size mortgages is quite significant at 29.18%, however, remains small in rand value at only 7.74% of total. The standard deviation across small, medium and large loan size segments was 12.39%, 2.1%, 12.55%. It appears there was much less variation in terms of volume of medium sized mortgages advanced, likely due to the drive to advance mortgages to the FSC and affordable market.

For all the variables, the kurtosis coefficients are below 3 thus indicating a flatter distribution. The results show positive skewness for the proportion of small and medium-sized mortgages (in rand value) and only the proportion of small-sized mortgages (in volume), indicating these distributions are positively skewed to the right. The results show negative skewness for the proportion of large-sized mortgages (in rand value and volume) and for medium-sized mortgages (in volume), highlighting these distributions are negatively skewed to the left. The variables in Table 7 can also be visualised from the graphical display in Figure 14.

b) Independent variables

Table 8 highlights an average quarterly gdp of 1.58% with a standard deviation of 3.68% over the 13-year period, highlighting South Africa's weak growth environment. The average quarterly house price index (hpi) growth was negative at -1.72% with a standard deviation of

4.45%, also reflecting weak house price growth on average. The average quarterly inflation of 5.85% with a standard deviation of 1.77%, highlights the well-managed monetary policy which on average kept inflation below the target of 6%. The average quarterly interest rate was 10.04, with a standard deviation of 1.91% over the period, the low variation around the mean also reflects minimal shocks to the system because of a well-managed monetary policy.

Table 8: Descriptive Statistics Independent Variables Q4:2007 - Q4:2020

Variables	***gdp***	***hpi***	***inf***	***ir***
Mean	0.015787	-0.017162	0.058472	0.100377
Median	0.017032	-0.006111	0.057000	0.100000
Maximum	0.164000	0.039104	0.116000	0.155000
Minimum	-0.170878	-0.183758	0.024000	0.070000
Std. Dev.	0.036806	0.044660	0.017729	0.019149
Skewness	-1.263329	-2.328767	0.980637	1.491831
Kurtosis	18.241050	8.084733	4.438462	5.156301
Observations	53	53	53	53

Note:gdp = Gross domestic product; hpi = house price index; inf = inflation rate and ir = interest rate.

For all the variables, the kurtosis coefficients are above 3, indicating a peaked distribution and the negative skewness for gdp and hpi reflects distributions that are skewed to the left and positive skewness for inflation and interest rates, indicates distributions that are positively skewed toward the right. The variables in Table 8 can also be visualised from the graphical display in Figure 15.

4.3 Variance Inflation Factor

The Variance Inflation Factor (VIF) test was performed to verify that no severe multicollinearity exists between the independent variables, i.e., the independent variables are not highly correlated. If the independent variables move too closely with one another, it is recommended to remove them as the regression results could be spurious. Knock and Lynn (2012) discuss the various literature indicating a centred VIF threshold of less than 3.3, 5 or 10 to suggest the existence of collinearity among the variables. Table 9 shows the results of the model, highlighting the centered VIF of less than the 3.3 for all the variables. This indicates no severe multicollinearity exists between the independent variables; thus, it is safe to keep all the independent variables in the model.

Table 9: Variance Inflation Factor test on independent variables

Variables	*Coefficient Variance*	*Uncentered VIF*	*Centered VIF*
gdp	0.000055	1.266581	1.066590
hpi	0.000080	2.647956	2.301549
inf	0.000718	39.236170	3.246401
ir	0.000518	79.260610	2.732537
c	0.000003	47.301490	NA

Note: gdp = Gross domestic product; hpi = house price index; inf = inflation rate and ir = interest rate.

4.4 Unit root test

a) Graphical analysis of variables

A graphical analysis of the variables is displayed in Figures 13 to 15 below. The graphs highlight that majority of the variables in the study are most likely non-stationary at level and majority of the variables have a strong upward or downward trend.

Figure 13 shows how the proportion of mortgage supply, in rand value and volume, have consistently declined to low- and middle-income households while increasing to high income households, visually demonstrating how wealth inequality in terms of property ownership have widened as the lower- and middle-income households do not by far have the same access to mortgage finance as high-income households do. The former is the direct result of the full implementation of the National Credit Act in 2007, interest rate hikes and the impact of the global financial market crisis (Global Property Guide, n.d as cited in Chipswa, 2017).

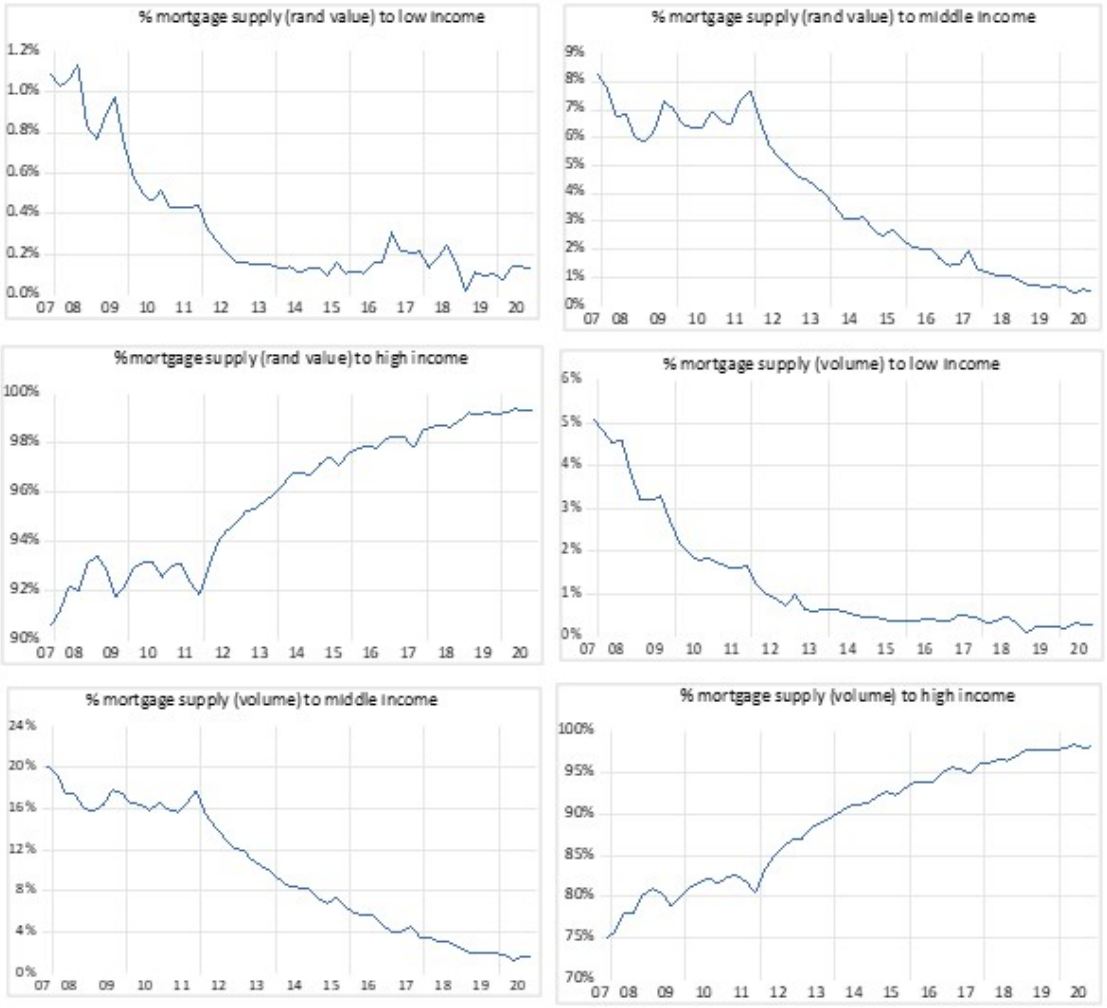


Figure 13: Graphical depiction of independent variables: mortgage supply (household income) 2007:Q4 to 2020:Q4

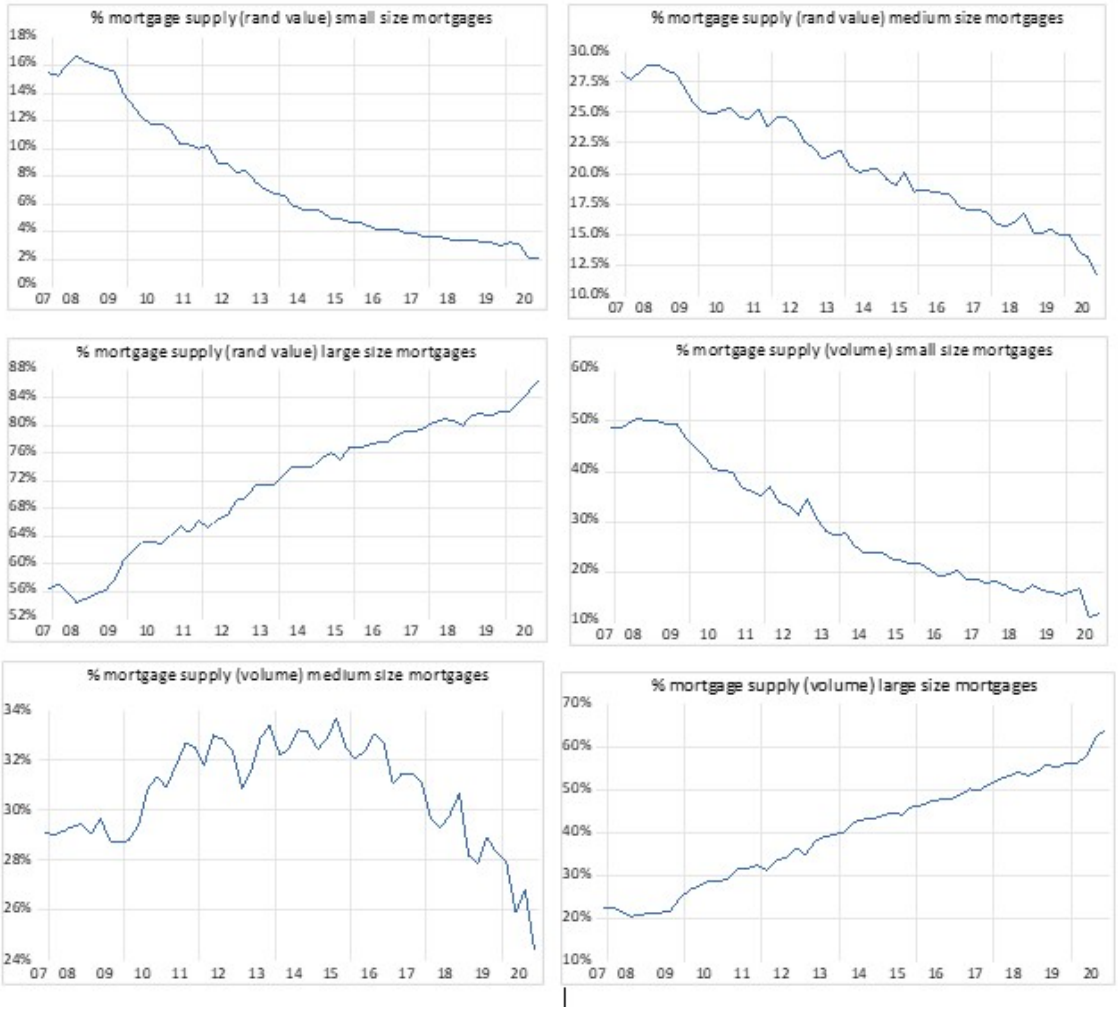


Figure 14: Graphical depiction of independent variables: mortgage supply (loan size) 2007:Q4 to 2020:Q4

A similar picture can be seen in Figure 14, where the proportion of mortgage supply, in rand value and volume, advanced by loan size, have consistently declined for low and medium-size mortgages while increasing for large-size mortgages, except for the volume of medium-size mortgages for a period between 2009 and 2016, where this group saw an increase. This is most likely due to the banking sectors commitment to advance mortgages to the FSC and affordable markets.

It is also worth noting that pre-global financial markets recession, the proportion of small- and medium-size mortgages advanced were approximately 50% and 30% respectively, which was greater than the proportion of large size mortgages advanced, at approximately 20%. This picture completely reversed over the period analysed. This was mainly driven by the property price boom during 2000 to 2006 (Global Property Guide, n.d as cited in Chipswa, 2017).

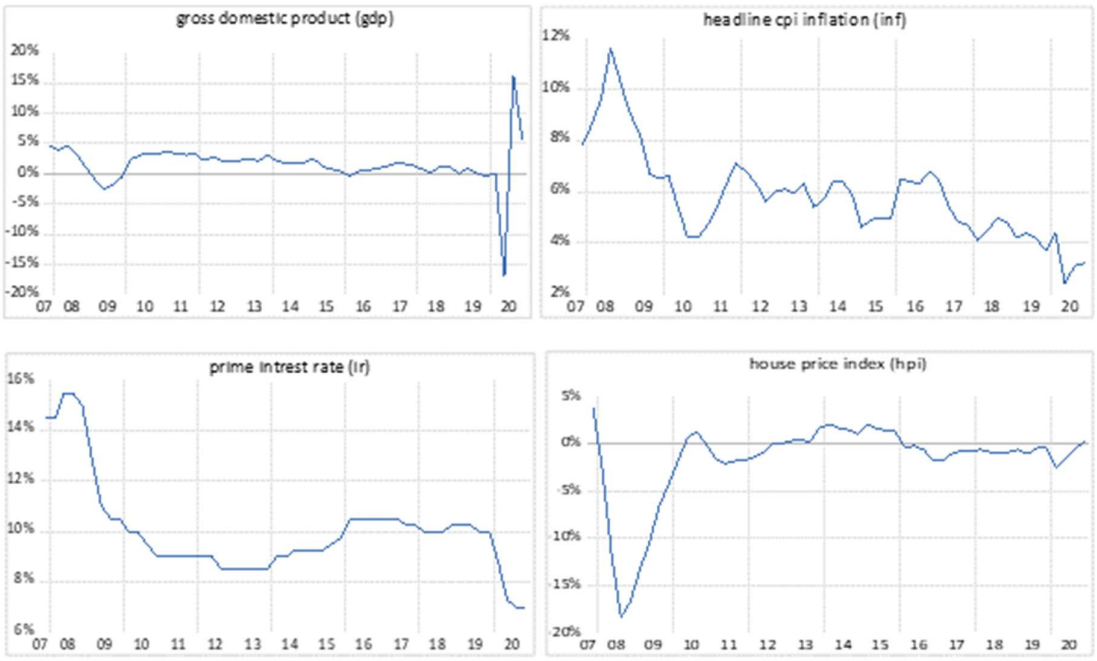


Figure 15: Graphical depiction of independent variables 2007:Q4 to 2020:Q4

GDP and house prices reflect a fairly stable trend with shocks to the system as a result of the global financial crisis in 2008 as well as the COVID pandemic in 2020. Inflation and the prime interest rate exhibit a downward trend.

b) Augmented Dicky Fuller test results

Next, the Augmented Dicky Fuller (ADF) test was performed on each of the variables to test for the presence of unit roots in each of the variables. The presence of unit roots implies the data is non-stationary and not suitable to be utilised in the regression model. The AIC determined the optimal lag length for the ADF test. The Phillips-Perron (PP) was run as a secondary test to verify the results of the ADF. The results are displayed in Table 10 and 11 below.

If the ADF test statistic in absolute value is greater than critical value at the 5% significance level, then the null hypothesis that a unit root is present is rejected. Conversely, if the ADF test statistic is less than the critical value at the 5% significance level, the null hypothesis that a unit root is present in the data fails to be rejected.

Table 10 shows the ADF test performed on level data. The test failed to reject the null hypothesis for all the variables, apart from *gdp* and *rv_med (*proportion of mortgage supply in

rand value for medium loan size). This implies that majority of the data is non-stationary at level and only *gdp* and *rv_med* is stationary at level, i.e., I(0). The PP test confirms the results for all the data, apart from the proportion of mortgage supply in volume to low-income (*vol_low*), which found it to be stationary at level.

Table 10: ADF and PP unit root tests at levels

	ADF					PP			
Variable	**Lag**	**T-Stat**	**TCV (5%)**	**P-Val**	**Decision**	**T-Stat**	**TCV (5%)**	**P-Val**	**Decision**
			LEVEL				**LEVEL**		
rv_low	0	-1.89	-3.499	0.6452	Non-Stationary	-1.662	-3.499	0.7538	Non-stationary
rv_mid	9	-3.133	-3.518	0.112	Non-Stationary	-2.197	-3.499	0.4811	Non-stationary
rv_high	2	-1.699	-3.502	0.7368	Non-Stationary	-2.279	-3.499	0.437	Non-Stationary
vol_low	0	-2.597	-3.499	0.2835	Non-Stationary	-5.352	-3.499	0.0003	Stationary
vol_mid	0	-1.748	-3.499	0.7154	Non-Stationary	-1.748	-3.499	0.7154	Non-stationary
vol_high	0	-1.945	-3.499	0.6165	Non-Stationary	-1.937	-3.499	0.6212	Non-stationary
rv_sml	3	-1.412	-3.504	0.8451	Non-Stationary	-0.816	-3.499	0.9574	Non-stationary
rv_med	0	-3.869	-3.499	0.0205	Stationary	-3.924	-3.499	0.0178	Stationary
rv_lrg	1	-1.929	-3.5	0.625	Non-Stationary	-2.072	-3.499	0.5487	Non-stationary
vol_sml	3	-0.871	-3.504	0.9511	Non-Stationary	-1.65	-3.499	0.7588	Non-stationary
vol_med	10	1.342	-3.521	1	Non-Stationary	1.248	-3.499	0.9999	Non-stationary
vol_lrg	0	-3.239	-3.499	0.0882	Non-Stationary	-3.252	-3.499	0.0859	Non-stationary
gdp	1	-4.658	-3.506	0.0024	Stationary	-8.248	-3.499	0	Stationary
Hpi	0	-2.005	-2.919	0.2839	Non-Stationary	-3.443	-3.499	0.0567	Non-stationary
Inf	0	-2.407	-3.499	0.3718	Non-Stationary	-2.724	-3.499	0.2317	Non-stationary
Ir	1	-2.659	-3.5	0.2571	Non-Stationary	-1.839	-3.499	0.671	Non-stationary

Note: rv_low= Proportion (%) of mortgages in total rand value granted to low-income; rv_mid= Proportion (%) of mortgages in total rand value granted to middle income; rv_high =Proportion (%) of mortgages in total rand value granted to high income; vol_low = Proportion (%) of mortgages in volume granted to low income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high =Proportion (%) of mortgages in volume granted to high income. rv_sml=Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med=Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg=Proportion (%) of mortgages in total rand value granted for large size mortgages; vol_sml =Proportion (%) of mortgages in volume granted for small mortgages; vol_med=Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg=Proportion (%) of mortgages in volume granted for large mortgages. gdp=Gross domestic product; hpi= house price index; inf=inflation rate and ir=interest rate. Source: Candidates estimates from research data.

Table 11 below shows the ADF test performed on the 1st difference data. The test results rejected the null hypothesis of the presence of a unit root for all the variables, apart from the proportion of the volume of small mortgages advanced (*vol_sml*). Thus, the data is stationary at 1st difference, i.e. I(1) for all the variables apart from *vol_sml*. The PP test, however, found this variable to be non-stationary at 1st difference. The dependent and independent variables are thus of mixed order integration with the independent variable gdp being I(0), and all other variables being I(1).

Table 11: ADF and PP unit root tests at 1st difference

		ADF				PP			
Variable	**Lag**	**T-Stat**	**TCV (5%)**	**P-Val**	**Decision**	**T-Stat**	**TCV (5%)**	**P-Val**	**Decision**
		1st DIFFERENCE				**1st DIFFERENCE**			
rv_low	0	-7.494	-3.5	0	Stationary	-11.2	-3.5	0	Stationary
rv_mid	1	-6.356	-3.502	0	Stationary	-5.993	-3.5	0	Stationary
rv_high	1	-6.6532	-3.502	0	Stationary	-7.827	-3.5	0	Stationary
vol_low	1	-6.817	-3.502	0	Stationary	-7.004	-3.5	0	Stationary
vol_mid	0	-6.493	-3.501	0	Stationary	-6.463	-3.5	0	Stationary
vol_high	1	-6.26	-3.502	0	Stationary	-7.162	-3.5	0	Stationary
rv_sml	2	-5.604	-3.504	0.0001	Stationary	-6.599	-3.5	0	Stationary
rv_med	1	-5.999	-3.502	0	Stationary	-8.086	-3.5	0	Stationary
rv_lrg	0	-7.106	-3.5	0	Stationary	-7.107	-3.5	0	Stationary
vol_sml	3	-3.271	-3.506	0.0835	Non-Stationary	-9.003	-3.5	0	Stationary
vol_med	9	-4.998	-3.521	0.0011	Stationary	-10.7	-3.5	0	Stationary
vol_lrg	0	-7.886	-3.5	0	Stationary	-7.886	-3.5	0	Stationary
gdp	1	-6.176	-3.502	0	Stationary	-17.31	-3.5	0	Stationary
hpi	5	-4.473	-3.511	0.0044	Stationary	-3.713	-3.5	0.0304	Stationary
inf	3	-4.836	-3.506	0.0015	Stationary	-6.09	-3.5	0	Stationary
ir	0	-3.895	-3.5	0.0194	Stationary	-3.648	-3.5	0.0355	Stationary

Note: rv_low= Proportion (%) of mortgages in total rand value granted to low-income; rv_mid= Proportion (%) of mortgages in total rand value granted to middle income; rv_high =Proportion (%) of mortgages in total rand value granted to high income; vol_low = Proportion (%) of mortgages in volume granted to low income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high =Proportion (%) of mortgages in volume granted to high income. rv_sml=Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med=Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg=Proportion (%) of mortgages in total rand value granted for large size mortgages; vol_sml =Proportion (%) of mortgages in volume granted for small mortgages; vol_med=Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg=Proportion (%) of mortgages in volume granted for large mortgages. gdp=Gross domestic product; hpi= house price index; inf=inflation rate and ir=interest rate. Source: Candidates estimates from research data.

4.5 Cointegration tests and long and short run equations

The next step is to conduct the cointegration tests to test for the presence of long-term relationships between the variables. Pesaran, Shin and Smith (2001) recommend using the Auto Regressive Distributive Lag (ARDL) model to test for cointegration when there is a mixed order of integration between I(0) or I(1). If the existence of a long-term relationship between the variables has been established, then the short- run Error Correction Model (ECM) can be estimated as per Pesaran, Shin and Smith (2001).

a) Mortgage supply in total rand value across household income segments

4.5.a.1 Cointegration test

The results of the ARDL bounds test for cointegration between dependent variables of mortgage supply across low-, middle- and high- household income (*rv_low*, *rv_mid* and *rv_high*) and the independent variables *gdp, hpi, inf* and *ir* are shown in Table 12. The F-statistic of 16.01, 5.88, and 6.41 is greater than the lower I(0) and upper bounds I(1) critical values at all significance levels. Thus, the null hypotheses that there is no cointegration amongst the variables for each model are rejected and it can be concluded that a long run relationship exists between each of the dependent variables and the set of independent variables, *gdp, hpi, infl* and *ir*.

Table 12:ARDL test for cointegration between % mortgage supply in rand value (household income) and independent variables

Dependent Variable	F-Statistic	10% CV		5% CV		1% CV		Optimal Lag Length	Decision
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)		
rv_low	16.01199	3.03	4.06	3.47	4.57	4.4	5.72	1,4,2,4,4	Reject Null
rv_mid	5.876615	3.03	4.06	3.47	4.57	4.4	5.72	3,2,0,4,4	Reject Null
rv_high	6.405472	3.03	4.06	3.47	4.57	4.4	5.72	3,2,0,4,4	Reject Null

Note: rv_low = Proportion (%) of mortgages in total rand value granted to low-income; rv_mid = Proportion (%) of mortgages in total rand value granted to middle income; rv_high = Proportion (%) of mortgages in total rand value granted to high income.

4.5.a.2 Long-run model

Table 13 summarises the results of the long run model, demonstrating which of the independent variables have a significant long run influence on the dependent variables modelled and the coefficients determines to what extent.

Table 13: Long run model with % mortgage supply in total rand value across household income market segments

Variables	***rv_low***			***rv_mid***			***rv_high***		
	coeff	t-stat	prob	coef.	t-stat	prob	coeff	t-stat	prob
gdp	0.029*	2.034	0.052	0.572**	2.095	0.045	-0.565**	0.248	0.030
hpi	0.066***	2.798	0.009	0.618*	1.878	0.070	-0.593**	0.287	0.047
inf	0.011	0.529	0.601	-0.486	-1.581	0.125	0.442	0.277	0.122
ir	0.192***	5.268	0.000	1.236*	1.717	0.096	-1.216*	0.601	0.052

Note: rv_low = Proportion (%) of mortgages in total rand value granted to low-income; rv_mid = Proportion (%) of mortgages in total rand value granted to middle income; rv_high = Proportion (%) of mortgages in total rand value granted to high income; GDP=Gross domestic product; hpi= house price index; inf=inflation rate and ir = interest rate. Source: Candidates estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

From Table 13, the coefficient of GDP implies that a 1% increase in economic growth results in a 2.9% increase in the proportion of mortgages in rand value advanced to low-income households, a 57.2% increase to middle-income households and a -56.5% increase to high-income households. The positive change in the proportion of mortgages advanced to low- and middle-income households were as expected as consumption and investment generally increases in a positive economic environment, as described by Filotto, Giannotti, Mattarocci and Scimone (2018) and Ayenew (2019). The results are also likely due to the FSC Charter, which saw banks originating a significant amount of mortgage finance to the FSC target market during the period, comprising of low- and middle-income market, but primarily middle-income market during the second round of funding between 2012 and 2019. The negative impact on the proportion of mortgages advanced to high-income households is in line with the findings by Anastasia and Diyanto (2018), who explained that in a strong growth environment, interest rate hikes can be triggered to curb inflation, which in turn will reduce demand for mortgages due to its higher cost. As highlighted by the NCR (2019), the proportion of mortgages advanced to the high-income market comprises the majority of loans, which likely explains the significant impact.

A 1% increase in housing prices captured by the *hpi* results in a 6.6% increase in the proportion of mortgages in total rand value advanced to low-income households, 61.8% to middle-income households and -59.3% to high-income households. This indicates that increasing house prices results in increased supply of mortgage finance to low- and middle-income households but reduces supply to high income households. A similar explanation as above can be explained for the change across the different market segments. The positive change to low- and middle-

income market is likely due to the increase in available mortgage finance due to the FSC loans granted during this period and also as house prices rise, first time buyers are more eager to get into the market before housing becomes unaffordable. Another plausible explanation is that a rise in property prices, specifically in new affordable housing developments, improved collateral, thereby stimulating further lending. The negative impact on high-income households is consistent with the literature in Filotto, Giannotti, Mattarocci and Scimone (2018) and Anastasia and Diyanto (2018), who explained that as house prices rise, the amount of disposable income available for home purchase declines thus the consumer is likely to postpone such investment. Again, high income households comprise the majority of market share for mortgage loans thus market movements are likely to influence this market segment more in line with most of the existing literature.

In respect of interest rates, a 1% increase in interest rates results in 19.2% increase to the proportion of mortgages in total rand value advanced to low-income households, 123.6% to middle-income and -121.6% to high-income households. The latter is consistent with existing literature on the South African market as discussed in Chipswa (2017), which analysed the whole market. Since the proportion of mortgages advanced to high-income households comprise the majority, the result is in alignment with Chipswa (2017). It was expected that that the lower- and middle-income market would be more sensitive to interest rate changes however, the results are most likely influenced by the FSC loans advanced to these market segments.

Chipswa (2017) also notes that mortgage supply is strongly affected when interest rates and inflation move in opposite directions, i.e., an increase in interest rates causes consumer to borrow and spend less, thus putting a lagged downward pressure on inflation and house prices, which in turn will cause an increase in housing demand and vice versa.

In summary, in the long run, gross domestic product, the house price index and interest rates have a positive and significant influence on the proportion of mortgages in total rand value advanced to low- and middle-income households, while having a negative and significant influence on the proportion of mortgages advanced to high-income households at the significance levels denoted in Table 16. The influence of inflation on all the dependent variables was insignificant with a *p*-value above 10%.

4.5.a.3 Short -run model

The ARDL bounds test confirmed the existence of a long-term relationship between the variables, therefore the short-run Error Correction Model (ECM) can be estimated for all the models. Table 14 shows the results of the ECM model with the dependent variables being the proportion of mortgages in total rand value advanced to low-, middle- and high-income households. The ECM shows that in the short run, interest rates have a negative influence on the proportion of mortgages advanced to low- and middle-income households, consistent with the literature and expectations as discussed above.

CointEq(-1) is the error correction term (ECT) and the coefficient of ECT must be between -1 and 0 in order to gradually correct to long run equilibrium. The coefficient determines the speed of adjustment back toward the long run equilibrium. Table 14 shows the ECT for all three models is statistically significant and the coefficients of -0.755, -0.325 and -0.372 across low-, middle- and high-income models suggest that the speed of adjustment is fast for low-income at 75.5%, 32.5% for the middle-income and 37.2% for the high-income model. i.e., the approximate percentage of the discrepancy between the long and the short run that is corrected within a quarter.

Table 14 shows that the regression models produced an R^2 of 88.9%, 64.8% and 67% for the proportion of mortgages in total rand value advanced to low-, middle- and high-income households respectively. This implies the estimated models are a good fit, implying that 88.9%, 64.8% and 67% of the variation can be explained by the three models respectively. The proportion of mortgages in total rand value advanced to low-income households has the best fit with the independent variables.

Table 14: ECM with dependent variables the % mortgage supply in total rand value by household income

Variable	*d(rv_low)**			*d(rv_mid)**			*d(rv_high)**		
	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.
c	-0.011	-10.06	0.000	-0.008	-5.72	0.000	0.380	6.08	0.000
@trend	0.000	-5.66	0.000	0.000	-5.18	0.000	0.001	5.31	0.000
d(dep_var(-1))*				0.084	0.71	0.481	0.084	0.73	0.472
d(dep_var(-2))*				-0.251	-2.21	0.035	-0.189	-1.62	0.115
d(gdp)	0.002	0.92	0.366	0.027	2.03	0.052	-0.030	-1.98	0.057
d(gdp(-1))	-0.009	-2.57	0.016	-0.097	-4.52	0.000	0.109	4.77	0.000
d(gdp(-2))	0.005	0.83	0.415						
d(gdp(-3))	0.028	3.76	0.001						
d(hpi)	0.066	5.38	0.000						
d(hpi(-1))	-0.034	-3.78	0.001						
d(inf)	0.083	5.31	0.000	0.230	3.18	0.003	-0.266	-3.42	0.002
d(inf(-1))	0.051	4.35	0.000	0.427	4.20	0.000	-0.478	-4.35	0.000
d(inf(-2))	0.058	4.74	0.000	0.394	4.15	0.000	-0.424	-4.14	0.000
d(inf(-3))	0.057	5.62	0.000	0.213	2.42	0.022	-0.251	-2.67	0.012
d(ir)	-0.021	-1.24	0.227	-0.277	-2.26	0.031	0.301	2.22	0.034
d(ir(-1))	-0.286	-10.45	0.000	-0.931	-5.16	0.000	1.104	5.58	0.000
d(ir(-2))	-0.198	-7.18	0.000	-0.721	-4.21	0.000	0.802	4.33	0.000
d(ir(-3))	-0.119	-5.19	0.000	-0.464	-3.09	0.004	0.506	3.06	0.005
CointEq(-1)	-0.755	-9.57	0.000	-0.325	-5.77	0.000	-0.372	-6.02	0.000
R-squared		0.889			0.648			0.670	
Adj. R-squared		0.834			0.503			0.534	
F-statistic		16.053			4.467			4.924	
Prob(F-statistic)		0.000			0.000			0.000	
No. of Obs.		49			49			49	

Note: rv_low = Proportion (%) of mortgages in total rand value granted to low-income; rv_mid = Proportion (%) of mortgages in total rand value granted to middle income; rv_high = Proportion (%) of mortgages in total rand value granted to high income; gdp=Gross domestic product; hpi= house price index; inf = inflation rate and ir = interest rate. Source: Candidates estimates from research data. *** *1% significance level, **5% significance level, * 10% significance level*

4.5.a.4 Model diagnostics

The next step is to perform relevant diagnostic and stability tests to check the validity and the reliability of the estimated regression models. This includes a normality test, serial correlation test, homoscedasticity test, linearity and stability tests.

The Breusch-Godfrey test was employed to test for the presence of serial correlation in the residuals. The null hypothesis is that no serial correlation is present in the residuals with the alternative hypothesis that there is serial correlation present. The results are shown in Table 15.

For the regression model *rv_low*, the p-value is less than 5%, thus reject the null hypothesis of no serial correlation. For regression models *rv_mid* and *rv_high*, the p-value is greater than 5%, thus fail to reject the null hypothesis of no serial correlation.

Table 15: Model diagnostics for mortgage supply in rand value across household income market segments

Model test	***p-value***	***rv_low***	***rv_mid***	***rv_high***
Breusch-Godfrey LM Test for Autocorrelation	*Prob. chi^2(4)*	0.015	0.328	0.342
White's test for heteroscedasticity	*Prob. chi^2*	0.948	0.416	0.992
Jarque-Bera test for normality	*p-value*	0.503	0.174	0.091

Note: rv_low = Proportion (%) of mortgages in total rand value granted to low-income; rv_mid = Proportion (%) of mortgages in total rand value granted to middle income; rv_high = Proportion (%) of mortgages in total rand value granted to high income. Source: Candidates estimates from research data.

White's test was used to test for heteroscedasticity, i.e., equal variance in the residuals. The null hypothesis is no heteroscedasticity in the residuals. The models p-values, shown in Table 15, are significantly above 5%, implying there is no evidence to reject the null hypothesis, i.e., the residuals have equal variance.

The Jarque-Bera test was employed to test for normality of the residuals. The null hypothesis is that the residuals are normally distributed. The p-values, shown in Table 15, are above 5% for all models, thus there is insufficient evidence to reject the null hypothesis.

To establish stability of the coefficients, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests were employed. All the CUSUM and CUSUM of square plots fall within the 5% significance level, thus no sign of structural breaks confirms that the three models can be used to make reliable projections. The graphs are shown in Figures 16, 17 and 18 in the Annexure.

b) Mortgage supply in volume across household income segments

4.5.b.1 Cointegration test

The results of the ARDL bounds test for cointegration between the dependent variables: the proportion of mortgage supply in volume across low-, middle- and high- household income (*vol_low*, *vol_mid* and *vol_high*) and the independent variables *gdp, hpi, inf* and *ir* are shown in Table 16 below. The F-statistic of 10.73, 4.92, and 5.57 is greater that the lower I(0) and upper bounds I(1) critical values at all significance levels. Thus, the null hypotheses that there is no cointegration amongst the variables for each model is rejected and it can be concluded that a long run relationship exists between each of the dependent variables and the set of independent variables, *gdp, hpi, infl and ir.*

Table 16: ARDL test for cointegration between % of mortgage supply in volume (household income) and independent variables

Dependent Variable	F-Statistic	10%		5% CV		1% CV		Optimal Lag Length	Decision
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)		
vol_low	10.73315	2.45	3.52	2.86	4.01	3.74	5.06	4,4,2,4,4	Reject Null
vol_mid	4.924447	3.03	4.06	3.47	4.57	4.4	5.72	1,2,0,4,4	Reject Null
vol_high	5.573452	3.03	4.06	3.47	4.57	4.4	5.72	1,2,0,4,4	Reject Null

Note: vol_low = Proportion (%) of mortgages in volume granted to low income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high = Proportion (%) of mortgages in volume granted to high income.

4.5.b.2 Long-run model

Table 17 summarises the results of the long run model, demonstrating which of the independent variables have a significant long run influence on the dependent variables modelled and the coefficients determine to what extent.

Table 17: Long run model with dependent variables % mortgage supply in volume across household income market segments

Variables	***vol_low***			***vol_mid***			***vol_high***		
	coeff	t-stat	prob	coef.	t-stat	prob	coeff	t-stat	prob
gdp	0.199**	2.582	0.016	0.765*	1.918	0.064	-0.751*	-1.913	0.065
hpi	0.385**	2.508	0.019	0.809*	2.024	0.051	-0.762*	-1.902	0.066
inf	0.174**	2.072	0.048	-0.830*	-1.787	0.083	0.978**	2.123	0.042
ir	0.746***	2.999	0.006	1.672*	1.968	0.058	-1.827**	-2.249	0.032

Note: vol_low = Proportion (%) of mortgages in volume granted to low income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high =Proportion (%) of mortgages in volume granted to high income. gdp=Gross domestic product; hpi= house price index; inf = inflation rate and ir = interest rate. Source: Candidates estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

In the long run, gross domestic product, house price index and interest rates have a positive and significant influence on the proportion of mortgages in volume advanced to low- and middle-income households, while having a negative and significant influence on the proportion of mortgages advanced to high-income households at the significance levels denoted in Table 17. The influence of inflation is significant on the proportion of mortgages advanced in volume across low-, middle- and high-income, with a negative influence on middle-income and a positive and significant influence on low- and high-income market segments.

The coefficients imply that a 1% increase in *gdp* results in a 19.9% increase in the proportion of mortgages in volume advanced to low-income households, a 76.5% increase to middle-income and a -75.1% to high-income households. Similar to the explanations provided for mortgages advanced in rand value and consistent with the literature, consumption and investment generally increases in a growing economy, thus demand and hence the volume of loan applications would increase and similarly the volume of loan approvals, with loans advanced to middle-income affected to a greater extent as a result of the FSC loans advanced. Similarly, a decline in mortgage applications from high-income households and/or a decline in approvals could be due to the higher cost of loans due to interest rate hikes to curb inflation in a growing economic environment.

A 1% increase in *hpi* results in a 38.5% increase in the proportion of mortgages in volume advanced to low-income, 80.9% to middle-income and –74.6% to high-income households. Again, similar to the explanation provided for rand value mortgages advanced, the increase in volume of mortgages to low- and middle-income households is likely due to higher demand from first time home-buyers accessing FSC loans and buying into affordable housing developments. A 1% increase in inflation results in a 17.4% increase in the proportion of mortgages in volume advanced to low-income households, a decline of 83% to middle-income and an increase of 97.8% to high-income households. Inflation affects the purchasing power of consumers; thus, lower affordability is likely to lead to a decline in the volume of loan applications and / or an increase in volume of bank rejections. The result for the middle-income market is consistent with this explanation. The increase in volume to low- and high-income households is unexpected and not consistent with existing literature but likely due to external factors such as mortgages advanced to low-income households who previously owned BNG housing and now using it as equity, similar to the high-income households, which could be dominated by the resale market where households have equity from the sale of a previous home.

A 1% increase in interest rates results in 74.6% increase in the proportion of mortgages in volume advanced to low-income households, 167.2% to middle-income and -182.7% to high-income households. Similar to the results on rand value mortgages, the increase in the proportion of mortgages in volume advanced to low- and middle-income is likely due to the FSC loans and the decline in the proportion of loans advanced to high income households is expected as a higher cost in the loan repayment would lower affordability and thus a decline in the number of loan applications and/ or an increase in the number of loan application rejections.

4.5.b.3 Short-run model

The ARDL bounds test confirmed the existence of a long-term relationship between the variables therefore short run Error Correction Model (ECM) can be estimated for all the models. Table 18 shows the results of the ECM model with the dependent variables being the proportion of mortgages in volume advanced to low-, middle- and high-income households.

The ECM shows that in the short run, interest rates have a negative influence on the proportion of mortgages in volume advanced to low- and middle-income households, consistent with expectations.

Table 18 shows that the ECT, *CointEq(-1)*, for all three models is statistically significant and the coefficients of -0.302, -0.375 and -0.420 across low-, middle- and high-income households reflect the speed of adjustment back toward the long run equilibrium.

Table 18 shows that the regression models produced an R^2 of 87.14%, 56.95% and 60.69% for the proportion of mortgages in volume advanced to low-, middle- and high-income households respectively. This implies the estimated models are a good fit with the proportion of mortgages in volume advanced to low-income households being the best fit with the independent variables.

Table 18: ECM with dependent variables % mortgage supply in volume across household income market segments

Variable	***d(vol_low)****			***d(vol_mid)****			***d(vol_high)****		
	coeff.	t-Stat	Prob.	coeff.	t-Stat	Prob.	coeff.	t-Stat	Prob.
c	-0.024	-7.99	0.000	0.026	4.22	0.000	0.385	5.70	0.000
@trend				-0.001	-5.07	0.000	0.002	5.28	0.000
d(dep_var(-1))*	-0.235	-2.06	0.050						
d(dep_var(-2))*	-0.277	-2.74	0.011						
d(dep_var(-3))*	-0.235	-2.15	0.041						
d(gdp)	-0.001	-0.10	0.921	0.062	2.58	0.015	-0.066	-2.45	0.020
d(gdp(-1))	-0.041	-4.14	0.000	-0.133	-3.62	0.001	0.147	3.81	0.001
d(gdp(-2))	-0.016	-0.90	0.378						
d(gdp(-3))	0.051	2.34	0.027						
d(hpi)	0.160	3.94	0.001						
d(hpi(-1))	-0.100	-3.66	0.001						
d(inf)	0.218	4.18	0.000	0.365	2.71	0.011	-0.367	-2.50	0.018
d(inf(-1))	0.072	1.99	0.058	0.800	4.28	0.000	-0.961	-4.53	0.000
d(inf(-2))	0.095	2.76	0.011	0.607	3.39	0.002	-0.671	-3.29	0.002
d(inf(-3))	0.089	3.13	0.004	0.337	2.05	0.048	-0.418	-2.30	0.028
d(ir)	-0.074	-1.23	0.228	-0.509	-2.26	0.031	0.515	2.02	0.051
d(ir(-1))	-0.479	-6.94	0.000	-1.565	-4.90	0.000	1.914	5.37	0.000
d(ir(-2))	-0.350	-5.13	0.000	-1.152	-3.78	0.001	1.362	4.00	0.000
d(ir(-3))	-0.193	-3.16	0.004	-0.633	-2.29	0.029	0.703	2.22	0.034
CointEq(-1)	-0.302	-7.87	0.000	-0.375	-5.26	0.000	-0.420	-5.60	0.000
R-squared		0.8714			0.56947			0.6069	
Adj. R-squared		0.7943			0.42596			0.4759	
F-statistic		11.298			3.96812			4.6323	
Prob(F-statistic)		0			0.00064			0.0002	
No. of Obs.		49			49			49	

Note: vol_low = Proportion (%) of mortgages in volume granted to low income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high = Proportion (%) of mortgages in volume granted to high income. gdp = Gross domestic product; hpi = house price index; inf = inflation rate and ir = interest rate. Source: Candidates estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

4.5.b.4 Model diagnostics

The next step is to perform the relevant diagnostic and stability tests to check the validity and the reliability of the estimated regression models. This includes a normality test, serial correlation test, homoscedasticity test, linearity and stability tests.

The Breusch-Godfrey test was employed to test for the presence of serial correlation in the residuals. The null hypothesis is that no serial correlation is present in the residuals with the

alternative hypothesis that there is serial correlation present. The results are shown in Table 19. For the all the regression models, the p-value is less than 5%, with *vol_mid* and *vol_high* the p-value is very close to 5%. thus reject the null hypothesis of no serial correlation and accept the alternative that serial correlation is present in the models.

Table 19: Model diagnostics for mortgage supply in volume across household income market segments

Model test	***p-value***	***vol_low***	***vol_mid***	***vol_high***
Breusch-Godfrey LM Test for Autocorrelation	*Prob. chi²(4)*	0.005	0.049	0.046
White's test for heteroscedacity	*Prob. chi²*	0.999	0.918	0.863
Jarque-Bera test for normality	*p-value*	0.753	0.032	0.014

Note: vol_low = Proportion (%) of mortgages in volume granted to low-income; vol_mid = Proportion (%) of mortgages in volume granted to middle income; vol_high = Proportion (%) of mortgages in volume granted to high income. Source: Candidates estimates from research data.

White's test was used to test for heteroscedacity, i.e., equal variance in the residuals. The null hypothesis is no heteroscedacity in the residuals. The models p-values, shown in Table 19, are significantly above 5%, implying there is no evidence to reject the null hypothesis, i.e., the residuals have equal variance.

The Jarque-Bera test was employed to test for normality of the residuals. The null hypothesis is that the residuals are normally distributed. The p-values are shown in Table 19. For *vol_low*, the p-value > 5%, so the null hypothesis is accepted, i.e., residuals are normally distributed. The models *vol_mid* and *vol-high* have p-values below 5%, thus reject the null hypothesis and conclude the residuals are not normally distributed.

To establish stability of the coefficients, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests were employed. All the CUSUM and CUSUM of square plots fall within the 5% significance level, thus no signs of structural breaks exist. The graphs are shown in Figures 19, 20 and 21 in the Annexure.

c) Mortgage supply in total rand value across loan sizes

4.5.c.1 Cointegration tests

The results of the ARDL bounds test for cointegration between the dependent variables: proportion of small-, medium- and large-size mortgages in rand value (*rv_sml*, *rv_med* and *rv_lrg*) and the independent variables *gdp, hpi, inf* and *ir* are shown in Table 20 below. The F-statistic of 15.16, 6.72, and 6.00 is greater that the lower I(0) and upper bounds I(1) critical values at all significance levels. Thus, the null hypotheses that there is no cointegration amongst the variables for each model is rejected and it can be concluded that a long run relationship exists between each of the dependent variables and the set of independent variables, *gdp, hpi, infl and ir.*

Table 20: ARDL test for cointegration between % mortgages in rand value across loan sizes and the independent variables

Dependent Variable	F-Statistic	10%		5% CV		1% CV		Optimal Lag Length	Decision
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)		
rv_sml	15.15956	3.03	4.06	3.47	4.57	4.4	5.72	4,3,3,0,0	Reject Null
rv_med	6.717955	3.03	4.06	3.47	4.57	4.4	5.72	1,3,2,4,0	Reject Null
rv_lrg	6.000155	2.45	3.52	2.86	4.01	3.74	5.06	4,3,3,4,0	Reject Null

Note: rv_sml = Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med =Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg = Proportion (%) of mortgages in total rand value granted for large size mortgages.

4.5.c.2 Long-run model

Table 21 summarises the results of the long run model, demonstrating which of the independent variables have a significant long run influence on the dependent variables modelled and the coefficients determines to what extent.

Table 21: Long run model with dependent variables the proportion of mortgages in rand value across loan sizes

Variables	***rv_sml***			***rv_med***			***rv_lrg***		
	coeff	t-stat	prob	coef.	t-stat	prob	coeff	t-stat	prob
gdp	0.467**	2.179	0.037	0.197*	1.767	0.086	-12.234	-1.254	0.220
hpi	-0.669***	-7.827	0.000	-0.121*	-1.796	0.082	2.688	1.518	0.140
inf	-0.362**	-2.517	0.017	-0.339	-1.579	0.124	14.096	0.848	0.403
ir	0.346	1.500	0.143	0.149	0.814	0.422	-17.190	-0.892	0.380

Note: rv_sml = Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med = Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg = Proportion (%) of mortgages in total rand value granted for large size mortgages; gdp = Gross domestic product; hpi = house price index; inf=inflation rate and ir = interest rate. Source: Candidates estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

The coefficients imply that a 1% increase in *gdp* results in a 46.7% and 19.70% increase in the proportion of mortgages in rand value advanced across small and medium size loans. Small and medium size loans are most likely advanced primarily to low- and middle-income households, however it could also be advanced to high-income households if the household has sufficient equity and only requires a smaller size loan to cover the balance of the cost of the home. As discussed in the literature, large size loans will only be advanced to high-income households due to affordability. The positive influence of gdp on the proportion of small and medium size loans advanced is likely as previously explained that banks are more willing to lend in a positive economic growth environment. The higher impact on small size loans in rand value could be due to an increase in resale properties where a consumer may have had equity in a previously owned government subsidised home or loans given in respect of land only sales. Small and medium size loans could also have been advanced to higher income households on a resale transaction where the household held equity in the sale of a previously owned home.

A 1% increase in *hpi* results in a 66.9% and 12.1% decline in the proportion of mortgages in total rand value advanced across small- and medium-size mortgages respectively. The negative influence on small and medium size mortgages is in line with expectations as a rise in house prices influences affordability, more so for small size mortgage applicants. A 1% increase in inflation rates results in 36.2% decline in the proportion of mortgages in rand value advanced across small loan sizes. An increase in inflation affects affordability and thus it is expected that small size mortgages would be most affected by this impact.

All variables influence was insignificant on the proportion of large size loans advanced perhaps as the advancement of large size loans is less influenced by market movements and more on the business of banks providing loans to those who meet their criteria. It was unexpected that the influence of interest rates was insignificant across all loan sizes.

In summary, gdp has a positive and significant influence on the proportion of small- and medium-size mortgages in total rand value, while having an insignificant influence on the proportion of large size mortgages advanced. The influence of house prices is negative and significant on the proportion of mortgages advanced in rand value across small and medium size mortgages and insignificant for large size mortgages. Interest rates is also insignificant across all loan sizes.

4.5.c.3 Short-run model

The ARDL bounds test confirmed the existence of a long-term relationship between the variables therefore the short-run Error Correction Model (ECM) can be estimated for all the models. Table 22 shows the results of the ECM model with the dependent variables being the proportion of mortgages in total rand value advanced across small-, medium- and large-size mortgages.

Table 22 shows that the ECT, *CointEq(-1)*, for all three models is statistically significant and the coefficients of -0.305, -0.812 and -0.036 across small, medium and large size mortgages, reflect the speed of adjustment back toward the long run equilibrium.

Table 22: ECM with dependent variables the proportion of mortgages in rand value across loan sizes

	*d(rv_sml)**			*d(rv_med)**			*d(rv_lrg)**		
Variable	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.
c	0.017	5.56	0.000	0.235	6.09	0.000	0.079	6.49	0.000
@trend	0.000	-6.14	0.000	-0.002	-6.13	0.000			
d(dep var(-1))*	-0.630	-6.86	0.000				-0.805	-5.90	0.000
d(dep_var(-2))*	-0.547	-5.39	0.000				-0.543	-3.41	0.002
d(dep_var(-3))*	-0.518	-5.83	0.000				-0.272	-2.11	0.043
d(gdp)	-0.015	-1.70	0.098	0.020	1.00	0.324	-0.012	-0.42	0.677
d(gdp(-1))	-0.162	-8.45	0.000	-0.189	-3.95	0.000	0.477	5.57	0.000
d(gdp(-2))	-0.167	-5.88	0.000	-0.119	-1.62	0.114	0.453	4.19	0.000
d(hpi)	-0.139	-4.18	0.000	-0.250	-1.98	0.056	0.238	1.25	0.221
d(hpi(-1))	-0.002	-0.06	0.954	0.247	2.75	0.010	0.110	0.50	0.620
d(hpi(-2))	0.075	2.74	0.010				-0.238	-1.55	0.133
d(inf)				-0.404	-2.15	0.039	0.575	2.24	0.032
d(inf(-1))				0.561	3.33	0.002	-0.295	-1.03	0.311
d(inf(-2))				0.048	0.46	0.646	-0.353	-1.43	0.164
d(inf(-3))				0.347	3.40	0.002	-0.590	-4.45	0.000
CointEq(-1)	-0.305	-9.22	0.000	-0.812	-6.14	0.000	-0.036	-5.83	0.000
R-squared		0.825			0.619			0.704	
Adjusted R-squared		0.773			0.506			0.582	
F-statistic		15.862			5.469			5.772	
Prob(F-statistic)		0.000			0.000			0.000	
No. of Observations		49			49			49	

Note: rv_sml = Proportion (%) of mortgages in total rand value granted for small mortgages; rv_med = Proportion (%) of mortgages in total rand value granted for medium size mortgages; rv_lrg = Proportion (%) of mortgages in total rand value granted for large size mortgages; gdp = Gross domestic product; hpi = house price index; inf=inflation rate and ir = interest rate. Source: Candidates estimates from research data. *** *1% significance level, **5% significance level, * 10% significance level*

Table 22 shows that the regression models produced an R^2 of 82.5%, 61.9% and 70.4% for the proportion of mortgages in total rand value advanced across small-, medium- and large-size mortgages respectively. This implies the proportion of small size mortgages in total rand value has the best fit with the independent variables.

4.5.c.4 Model diagnostics

The next step is to perform the relevant diagnostic and stability tests to check the validity and the reliability of the estimated regression models. This includes a normality test, serial correlation test, homoscedacity test, linearity and stability tests.

The Breusch-Godfrey test was employed to test for the presence of serial correlation in the residuals. The null hypothesis is that no serial correlation is present in the residuals with the alternative hypothesis that there is serial correlation present. The results are shown in Table 23. For the regression model *rv_sml*, the p-value is greater than 5%, thus fail to reject the bull hypothesis. For the models *rv_med* and *rv_lrg*, the p-value is less than 5%, thus reject the null hypothesis of no serial correlation and accept the alternative that serial correlation is present in these models.

Table 23: Model diagnostics for mortgage supply in rand value across loan sizes

Model test	***p-value***	***rv_sml***	***rv_med***	***rv_lrg***
Breusch-Godfrey LM Test for Autocorrelation	*Prob. $chi^2(4)$*	0.613	0.009	0.008
White's test for heteroscedasticity	*Prob. chi^2*	0.934	0.967	0.999
Jarque-Bera test for normality	*p-value*	0.934	0.711	0.201

Note: rv_sml = Proportion (%) of mortgages in total rand value granted toward small mortgages; rv_med = Proportion (%) of mortgages in total rand value granted toward medium size loans; rv_lrg = Proportion (%) of mortgages in total rand value to large size mortgages. Source: Candidates estimates from research data.

White's test was used to test for heteroscedasticity, i.e., equal variance in the residuals. The null hypothesis is no heteroscedasticity in the residuals. The models p-values, shown in Table 23, are significantly above 5%, implying there is no evidence to reject the null hypothesis, i.e., the residuals have equal variance.

The Jarque- Bera test was employed to test for normality of the residuals. The null hypothesis is that the residuals are normally distributed. The p-values are shown in Table 23. All p-values

are greater than 5% thus fail to reject the null hypothesis and conclude that the residuals are normally distributed.

To establish stability of the coefficients, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests were employed. The CUMSUM of the *rv_sml* model highlighted some structural breaks in the stability of the coefficients; however, the CUMSUM squared showed stability of the coefficients in sudden changes. All the remaining models CUSUM and CUSUM of square plots fall within the 5% significance level, thus no signs of structural breaks confirms that the that the three models can be used to make reliable projections. The graphs are shown in Figures 22, 23 and 24 in the Annexure.

d) Mortgage supply in volume across loan sizes

4.5.d.1 Cointegration tests

The results of the ARDL bounds test for cointegration between the dependent variables: proportion of small, medium and large size mortgages in rand value (*vol_sml*, *vol_med* and *vol_lrg*) and the independent variables *gdp, hpi, inf* and *ir* are shown in Table 24 below. The F-statistic of 11.98, 7.69, and 8.22 is greater that the lower I(0) and upper bounds I(1) critical values at all significance levels. Thus, the null hypotheses that there is no cointegration amongst the variables for each model is rejected and it can be concluded that a long run relationship exists between each of the dependent variables and the set of independent variables, gdp, hpi, infl and ir.

Table 24: ARDL test for cointegration between dependent variables proportion of mortgages in volume across loan sizes

Dependent Variable	F-Statistic	10%		5% CV		1% CV		Optimal Lag Length	Decision
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)		
vol_sml	11.98498	3.03	4.06	3.47	4.57	4.4	5.72	4,0,4,0,4	Reject Null
vol_med	7.688798	2.45	3.52	2.86	4.01	3.74	5.06	4,2,1,0,2	Reject Null
vol_lrg	8.217679	3.03	4.06	3.47	4.57	4.4	5.72	1,2,3,0,0	Reject Null

Note: vol_sml =Proportion (%) of mortgages in volume granted for small mortgages; vol_med=Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg=Proportion (%) of mortgages in volume granted for large mortgages Source: Candidates estimates from research data.

4.5.d.2 Long-run model

Table 25 summarises the results of the long-run model, demonstrating which of the independent variables have a significant long-run influence on the dependent variable modelled and the coefficients determine to what extent.

Table 25: Long run model with dependent variables the proportion of mortgage supply in volume across loan sizes

Variables	***vol_sml***			***vol_med***			***vol_lrg***		
	coeff	t-stat	prob	coef.	t-stat	prob	coeff	t-stat	prob
gdp	-0.196*	-1.848	0.074	1.086***	2.716	0.010	-0.305*	-1.716	0.094
hpi	-2.473***	-5.845	0.000	0.839***	3.438	0.002	0.424***	5.034	0.000
inf	-1.488***	-3.725	0.001	1.676***	4.258	0.000	0.116	0.618	0.540
ir	-1.633***	-3.181	0.003	0.463	1.043	0.304	-0.034	-0.193	0.848

Note: vol_sml =Proportion (%) of mortgages in volume granted for small mortgages; vol_med = Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg = Proportion (%) of mortgages in volume granted for large mortgages. gdp = Gross domestic product; hpi = house price index; inf = inflation rate and ir = interest rate. Source: Candidates estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

The coefficients imply that a 1% increase in *gdp* results in a 108.6% increase in the proportion of medium size mortgages advanced and a 19.6% and 30.5% decline in the proportion of small- and large-size mortgages respectively. Similar to the explanation to middle-income households, the significant increase in medium-size loans is likely as a result of the FSC loans advanced to the low- and middle-income market segment. The decline in the proportion of small- and large-size mortgages could be explained by a decline in applications and/or approvals for small and large size mortgages when interest rates are hiked to curb inflation when the economy is growing, in line with the findings by Anastasia and Diyanto (2018).

A 1% increase in *hpi* resulted in a decline of 247.3% in the proportion of small size mortgages advanced and an increase of 83.9% and 42.4% in the proportion of medium and large size mortgages advanced respectively. The former is as expected and similar to rand value mortgages across small size loans, rising house prices influence affordability, specifically for the lower end of the market, which will be seen in a decline in the proportion of small size loans. The latter is likely due to an increase in loans advanced on the back of collateral / security to the bank increasing because of rising house prices. This is especially the case in new developments as banks gain confidence in areas if there is a growing house price trend. A 1% increase in *inf* resulted in a 48.8% decline in the proportion of small size mortgages and a 167.6% increase in the proportion of medium size mortgages advanced. The former is

consistent with the literature by Chipswa (2017) as higher inflation affects disposable income and thus affordability, it is expected that the proportion of small size mortgages advanced would decline. The increase in the proportion of medium size mortgages is once again likely influenced by the FSC loans advanced during the period. A 1% increase in *ir* results in a decline of 163.3% in the proportion of small size mortgages advanced. This is also consistent with the literature by Chipswa (2017) as rising interest rates affect affordability, it is expected that the proportion of small size mortgages would be significantly affected.

In summary, gdp and hpi have a significant influence on all the dependent variables at the significance level denoted in Table 24. Gdp has a positive influence on the proportion of medium size mortgages advanced in volume and negative on the proportion of small and large size mortgages advanced in volume. Hpi has a negative influence on the proportion of small size mortgages advanced in volume and positive on the proportion of medium and large size mortgages advanced in volume. Inflation was significant only on the proportion of small and medium size loans advanced with a negative and positive correlation respectively. Interest rates was negative and significant on the proportion of small size mortgages advanced, and insignificant on the proportion of medium and large size mortgages advanced.

4.5.d.3 Short-run model

The ARDL bounds test confirmed the existence of a long-term relationship between the variables therefore the short run Error Correction Model (ECM) can be estimated for all the models. Table 26 shows the results of the ECM model with the dependent variables being the proportion of mortgages in volume advanced across small-, medium- and large-size mortgages.

Table 26 shows that the ECT, *CointEq(-1)*, for all three models is statistically significant and the coefficients of -0.623, -0.353 and -0.841 across small-, medium- and large-size mortgages, reflect the speed of adjustment back toward the long run equilibrium.

Table 26: ECM with dependent variables the proportion of mortgage supply in volume across loan sizes

Variable	***d(vol_sml)****			***d(vol_med)****			***d(vol_lrg)****		
	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.	Coeff.	t-Stat	Prob.
c	0.408	7.68	0.000	0.057	6.43	0.000	0.180	6.93	0.000
@trend	-0.004	-7.41	0.000				0.006	6.81	0.000
d(dep_var(-1))*	-0.365	-4.29	0.000	-0.115	-0.95	0.347			
d(dep_var(-2))*	-0.433	-4.11	0.000	-0.489	-4.47	0.000			
d(dep var(-3))*	-0.494	-4.77	0.000	-0.217	-1.72	0.094			
d(gdp)				0.077	3.26	0.003	0.057	2.18	0.035
d(gdp(-1))				-0.239	-6.78	0.000	0.237	5.86	0.000
d(hpi)	-0.823	-3.95	0.000	0.110	1.21	0.235	0.210	2.11	0.042
d(hpi(-1))	0.412	2.58	0.015				-0.055	-0.51	0.611
d(hpi(-2))	0.578	4.96	0.000				-0.355	-3.86	0.000
d(hpi(-3))	0.299	2.34	0.026						
d(ir)	0.586	1.74	0.091	-0.155	-0.69	0.498			
d(ir(-1))	1.916	4.87	0.000	-0.674	-2.51	0.017			
d(ir(-2))	1.104	3.03	0.005						
d(ir(-3))	1.204	3.64	0.001						
CointEq(-1)	-0.623	-8.23	0.000	-0.353	-6.55	0.000	-0.841	-6.74	0.000
R-squared		0.8110			0.6626			0.6399	
Adj. R-squared		0.7408			0.5848			0.5799	
F-statistic		11.5523			8.5114			10.6629	
Prob(F-statistic)		0.0000			0.0000			0.0000	
No. of Obs.		49			49			50	

Note: vol_sml = Proportion (%) of mortgages in volume granted for small mortgages; vol_med = Proportion (%) of mortgages in volume granted for medium mortgages; vol_lrg = Proportion (%) of mortgages in volume granted for large mortgages. gdp = Gross domestic product; hpi = house price index; inf = inflation rate and ir = interest rate. Source: Candidates' estimates from research data. **** 1% significance level, **5% significance level, * 10% significance level*

Table 26 shows that the regression models produced an R^2 of 81.1%, 66.3% and 64% for the proportion of mortgages in volume advanced across small-, medium- and large-size loans respectively. This implies the proportion of small-size mortgages in volume has the best fit with the independent variables.

4.5.d.4 Model diagnostics

The next step is to perform the relevant diagnostic and stability tests to check the validity and the reliability of the estimated regression models. This includes a normality test, serial correlation test, homoscedasticity test, linearity and stability tests.

The Breusch-Godfrey test was employed to test for the presence of serial correlation in the residuals. The null hypothesis is no serial correlation in the residuals with the alternative hypothesis that there is serial correlation present. The results are shown in Table 27. For the regression model *rv_sml*, the p-value is greater than 5%, thus fail to reject the bull hypothesis. For the models *rv_med* and *rv_lrg*, the p-value is less than 5%. thus reject the null hypothesis of no serial correlation and accept the alternative that serial correlation is present in these models.

Table 27: Model diagnostics for mortgage supply in volume across loan sizes

Model test	***p-value***	***vol_sml***	***vol_med***	***vol_lrg***
Breusch-Godfrey LM Test for Autocorrelation	*Prob. chi^2(4)*	0.789	0.657	0.465
White's test for heteroscedasticity	*Prob. chi^2*	0.914	0.997	0.562
Jarque-Bera test for normality	*p-value*	0.004	0.742	0.229

Note: vol_sml = Proportion (%) of mortgages in volume granted toward small mortgages; vol_med = Proportion (%) of mortgages in volume granted toward medium size loans; vol_lrg = Proportion (%) of mortgages in volume to large size mortgages. Source: Candidates' estimates from research data.

White's test was used to test for heteroscedasticity, i.e., equal variance in the residuals. The null hypothesis is no heteroscedasticity in the residuals. The models p-values, shown in Table 27, are significantly above 5%, implying there is no evidence to reject the null hypothesis, i.e., the residuals have equal variance.

The Jarque-Bera test was employed to test for normality of the residuals. The null hypothesis is that the residuals are normally distributed. The p-values are shown in Table 27. The p-value for model *vol_sml* is less than 5%, thus reject the null hypothesis and conclude that the residuals are not normally distributed. The p-values for *vol_med* and *vol_lrg* are greater than 5% thus fail to reject the null hypothesis and conclude that the residuals are normally distributed.

To establish stability of the coefficients, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests were employed. All the CUSUM and CUSUM of square plots fall within the 5% significance level, thus no signs of structural breaks confirms that the that the three models can be used to make reliable projections. The graphs are shown in Figures 25, 26 and 27 in the Annexure.

4.6 Summary

This chapter presented the findings of the methodology described in Chapter 3 applied to the data. The graphical display of the variables provided an indication of the stationarity of the variables, validated for most of the variables in ADF unit toot test. In hindsight, the researcher could have included a dummy variable in the regression equations to account for possible external shocks, such as the global financial crisis in 2008 and Covid-19 in 2020, as evidenced in the graphs of the independent variables displayed in Figure 15.

The ARDL test for cointegration proved that the macroeconomic variables and house prices have a long-term relationship with the dependent variables modelled, thus the short run ECM was estimated to calculate the short run adjustment back to equilibrium and the goodness of fit of the model. A limitation of the methodology employed is that granger causality tests was not conducted for the independent variables to address endogeneity in the models.

The next chapter concludes the study with a summary of the key findings and outlines some policy and further research recommendations.

Chapter 5

Conclusion and Recommendations

5.1 Introduction

This chapter presents a summary of the major findings and conclusions of the study examining the determinants of mortgage lending across different market segments and loan sizes in South Africa. Based on the analysis, policy recommendations are provided on how to stimulate lending to the lower income market to change the future trajectory of mortgage lending and home ownership in SA. The last section recommends future areas of research that could be further explored to expand on the body of knowledge.

5.2 Summary and conclusions

This study examined the influence of macroeconomic variables and house prices on mortgage lending across low-, middle- and high-income market segments, as well as across small, medium and large loan sizes.

The ARDL test found a positive and significant long-term relationship between gdp, interest rates and house prices and the proportion of mortgages in total rand value and volume advanced to low- and middle-income households. The former is consistent with existing literature as it is expected that households' economic conditions improve as the economy grows; however the latter two variables are inconsistent with existing literature which demonstrates that interest rates and house prices are inversely related to mortgage advances, however in the South African context, intervention through significant mortgage finance provision through FSC and FLISP for these income segments was made available to improve the socio-economic status of these households. The same variables had a significant and negative relationship with the proportion of mortgages in total rand value advanced to high-income households. The latter is consistent with existing literature, likely because mortgage advances to high income households make up the vast majority of mortgage advances. The short-run ECM show that the influence of interest rates on the proportion of mortgage advances to low- and middle-income households are negative in the short term.

Inflation had no significant influence on the proportion of mortgages in total rand value advanced to low- middle-and high-income households; however, it had a positive and significant long-term relationship on the proportion of mortgages in volume advanced to low- and high-income households and a negative and significant relationship on the proportion of mortgages in volume advanced to middle-income households.

Economic growth had a positive and significant influence on the proportion of small- and medium-size mortgages in total rand value, while house prices and inflation had a negative and significant influence on the proportion of small size mortgages. The latter is also true on the proportion of the number of small mortgages advanced. Similarly, interest rates also had a negative and significant impact on the proportion of the number of small mortgages advanced. Inflation, interest rates and house prices had a very high negative impact on the proportion of the number of small mortgages advanced as was expected, as the lower end is much more sensitive to changes in interest rates and inflation. House prices and inflation had a positive and significant influence on the proportion of the number of medium-size mortgages advanced, however, interest rates were found to be insignificant on this market segment. This is contrary to the literature, and most likely it is because there has been significant intervention through FSC mortgages and FLISP in this segment of the market. Economic growth, inflation, interest rates and house prices were all found to be insignificant on the proportion of large size mortgages in rand value. Inflation and interest rates were also found to be insignificant on the proportion of large size mortgages in volume.

The study highlights that market forces can influence market segments differently and specific policy interventions are required that consider changing market conditions. The lower end of the market is still mostly influenced by market conditions and thus minimal loans are advanced to this market segment. McGaffin (2018) suggests that there needs to be specific interventions targeted for different segments of the market.

5.3 Policy recommendations

The literature as well as the results of the study evidently show that there has been little to no priority to stimulate mortgage lending to the lower income market segment. The existing programs and policies, such as FLISP, have made an insignificant dent in mortgage lending to the lower income market. If specific policy interventions are not implemented and/or effective,

the current status quo of little to no mortgage lending to the lower- and middle-income markets will perpetuate especially since wages of these market segments do not generally keep up with inflation. The policy recommendations below could support banks to increase access to mortgage finance for the lower- and middle-income markets.

- Rent-to-buy is an alternative tenure scheme, being a hybrid between rental and ownership. The essence of a rent-to- buy scheme is that clients rent for a period of time, approximately 2-5 years, while being prepared for home ownership during the rental period, which includes home ownership education, clearing debts, improving credit scores, and saving toward a deposit is usually a portion of the rental. A rent-to-buy scheme can increase access to home ownership for a large portion of the gap market that currently do not have access because of affordability and access to credit constraints. It can assist aspiring home-buyers in the GAP market to save toward an equity contribution (deposit) to close the affordability gap over a period of time whilst the house price remains fixed. Turok (2018) proposes that a government supported rent to buy model for the GAP market will go a long way in making a tangible impact on the demand and supply side markets as households enter into a rent to buy program combined with the FLISP subsidy. Rent to buy schemes do exist in South Africa as pioneered by Meyer de Waal, a conveyancing attorney, in 2008 (*Rent2Buy, n.d.*), however it has primarily reached households in the upper GAP market, earning above R15K per month as the rental requirements have been out of reach for the lower income market. Rent to buy schemes are also very popular in a number of countries across the globe and its origin dates back to the 1950s and 60s in America and much earlier in Europe (Rent-to-own, 2021).
- CAHF have been advocating for the resale market of BNG houses for several years, which should include lessening the period to sell, currently at 8 years, as well as supporting banks to provide mortgages to this market. The literature review highlights the fast growth in value of these units, meaning that these households have sufficient equity to put toward a new property, thus enabling them to climb up the housing ladder.
- Banks should be required to incorporate the FLISP subsidy into affordability assessments of households. This will significantly improve access for lower- and middle-income households.

- The FLISP subsidy also needs to adjust annually with the rate of inflation as house prices increase annually so should the relative proportion of the subsidy. If wages do not increase above inflation, then the gap of affordability will continue to widen.
- Government should legislate the mortgage default insurance plan they approved in 2010 (National Housing Finance Corporation, 2011). This will enable banks to advance more mortgages to the lower- and middle-income households.

5.4 Future research

Future research can include debt to disposable income across different household market segments to highlight how significant this factor is in influencing banks' ability to advance mortgage finance. Another interesting angle would be to show how different market segments wage inflation have kept up relative to house price inflation and how this has influenced access to mortgage finance. Further research into innovative ways to reduce the cost of the basic entry level house will also significantly advance the goal to increase home ownership for the lower- and middle-income market segments. The role of Development Finance Institutions (DFI's) in enabling more efficient markets can also be explored.

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Annexure: Model diagnostics

1. Mortgage Supply in Rand Value by Household Income

- **Rand Value Low Income**

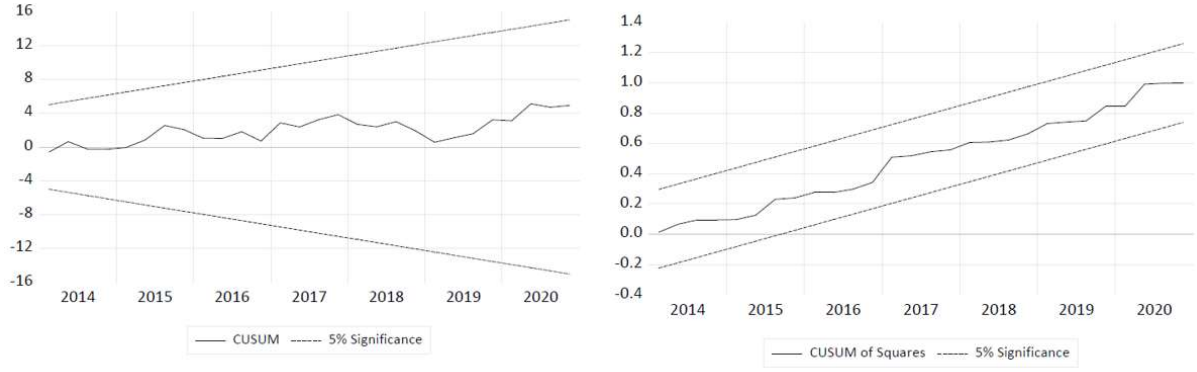

Figure 16: Mortgage Supply in Rand Value Model (Low Income)

- **Rand Value Middle Income**

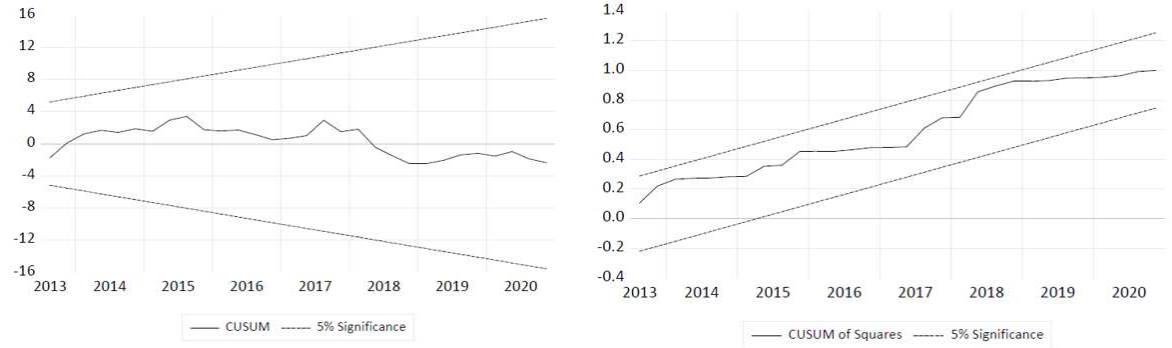

Figure 17: Mortgage Supply in Rand Value Model (Middle Income)

- **Rand Value High Income**

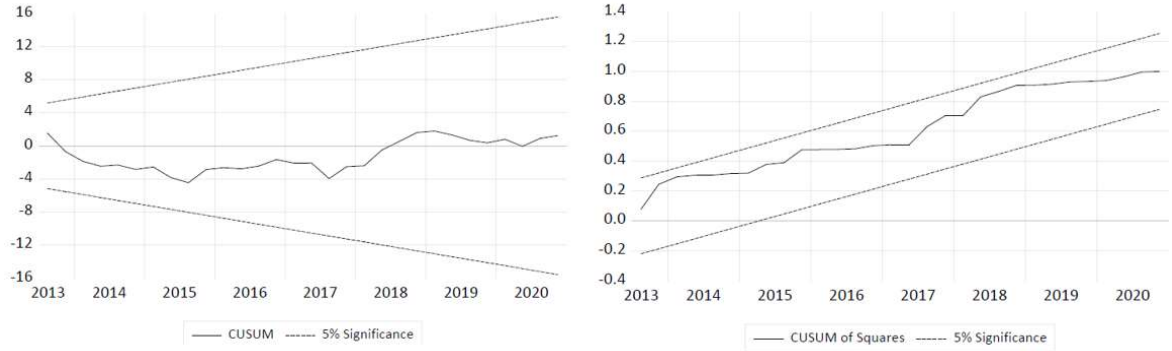

Figure 18:Mortgage Supply in Rand Value Model (High Income)

2. Mortgage Supply in Volume by Household Income

- **Volume Low Income**

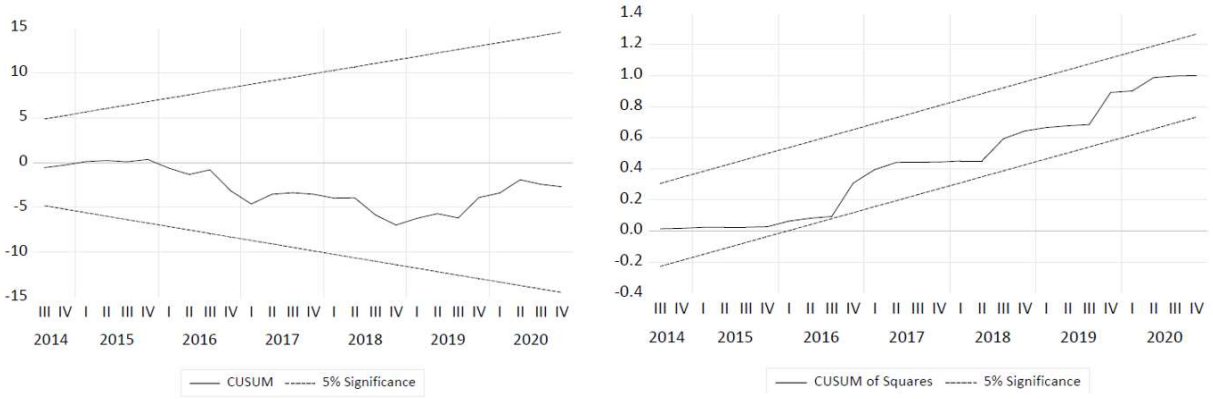

Figure 19:Mortgage Supply in Volume Model (Low Income)

- **Volume Middle Income**

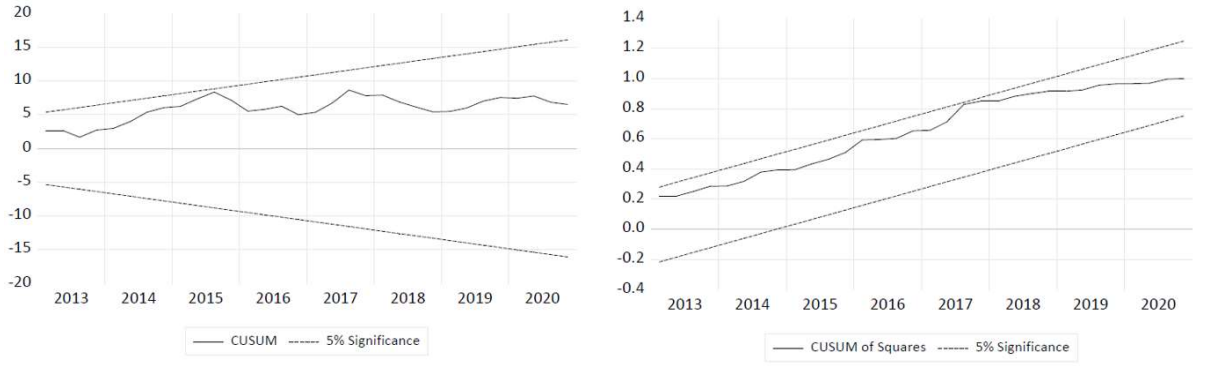

Figure 20: Mortgage Supply in Volume Model (Middle Income)

- **Volume High Income**

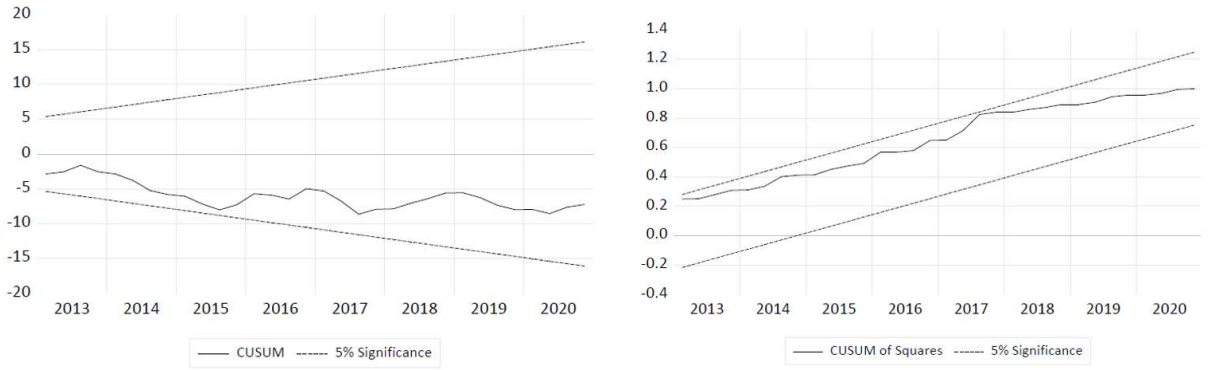

Figure 21:Mortgage Supply in Volume Model (High Income)

3. Mortgage Supply in Rand Value by Loan Size

- **Rand Value Small Loan Size**

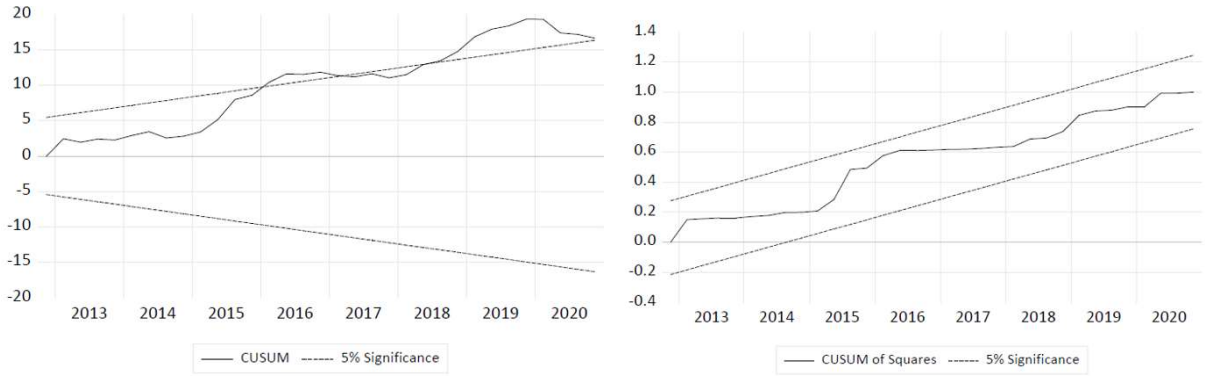

Figure 22:Mortgage Supply in Rand Value Model (Small Loan Size)

- **Rand Value Medium Loan Size**

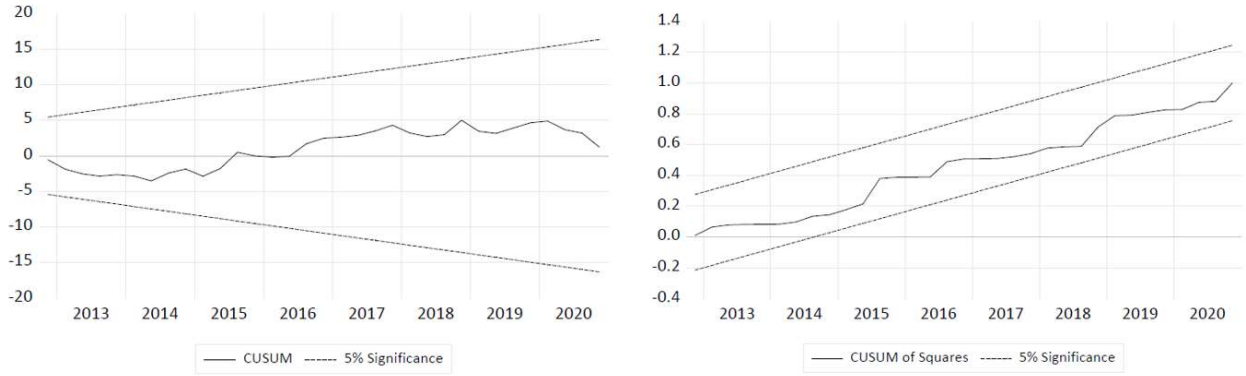

Figure 23:Mortgage Supply in Rand Value Model (Medium Loan Size)

- **Rand Value Large Loan Size**

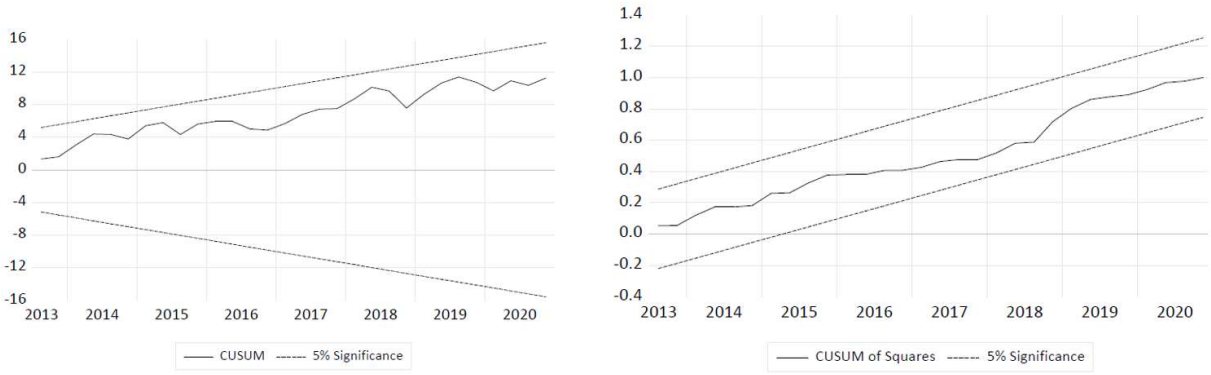

Figure 24:Mortgage Supply in Rand Value Model (Large Loan Size)

4. Mortgage Supply in Volume by Loan Size

- **Volume Small Loan Size**

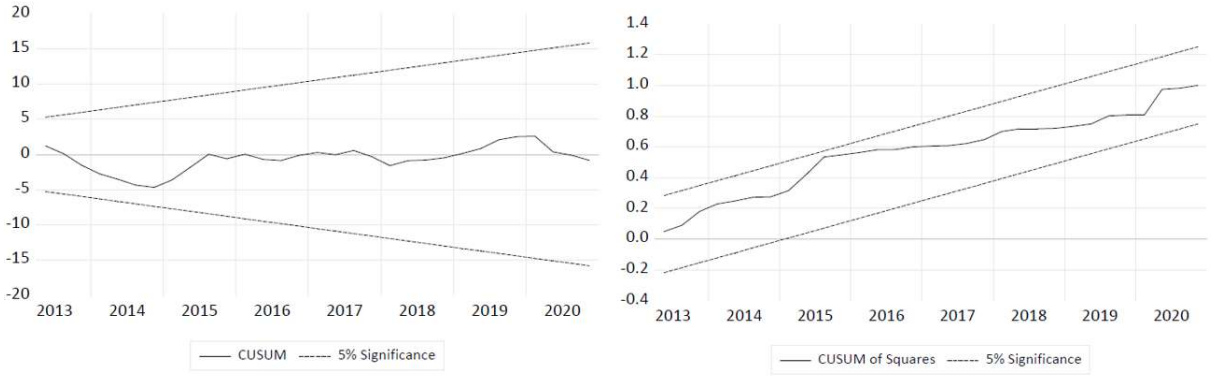

Figure 25:Mortgage Supply in Volume Model (Small Loan Size)

- **Volume Medium Loan Size**

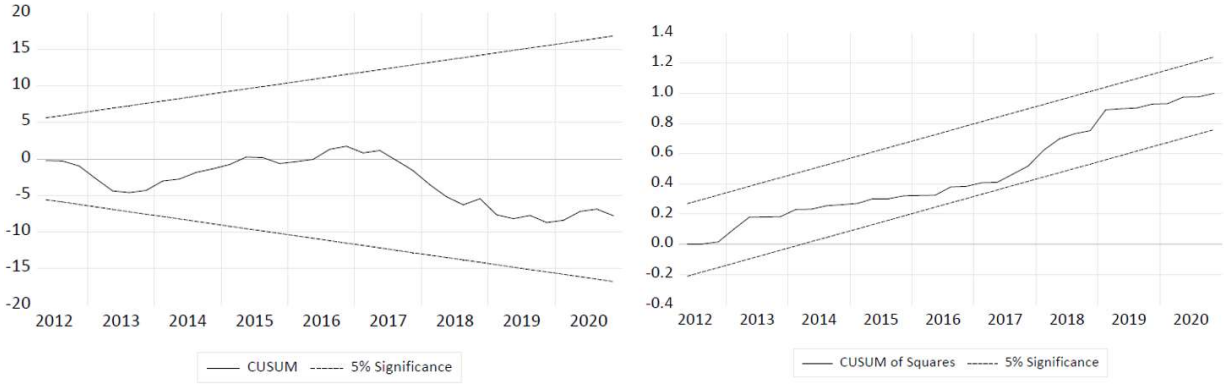

Figure 26:Mortgage Supply in Volume Model (Medium Loan Size)

- **Volume Large Loan Size**

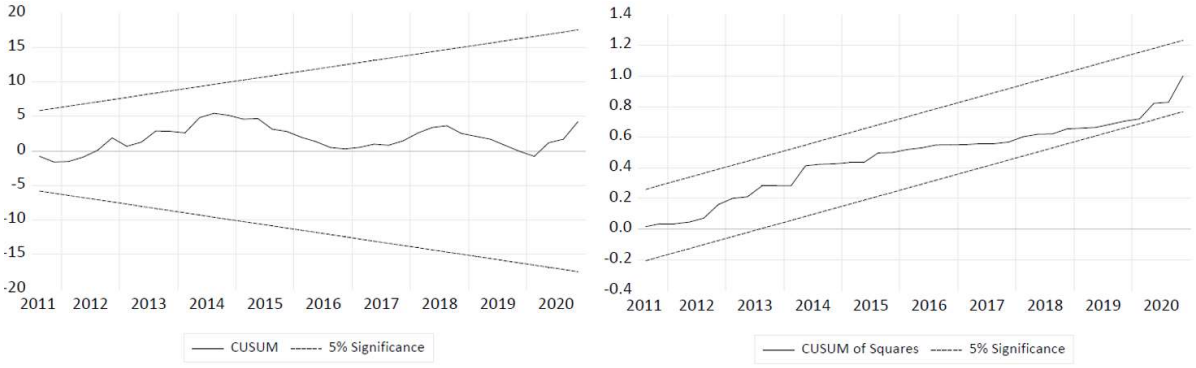

Figure 27:Mortgage Supply in Volume Model (Large Loan Size)