AN ANALYSIS OF MACROECONOMIC DETERMINANTS OF HOUSE PRICE VOLATILITY IN NAMIBIA

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ABSTRACT

The housing sector plays a significant role in the economy. However, house prices are presumed to be more volatile than other goods and services, because of their high demand. This study aimed to conduct an empirical analysis of the determinants of house price volatility in Namibia. Moreover, the direction of causality between house price volatility and the macroeconomic determinants was examined. The ARCH and GARCH models together with the VAR/VECM approaches were used to analyse quarterly data from 2007 quarter 1 to 2017 quarter 2. The findings show that house prices in Namibia are volatile and the volatility is highly persistent. A long run relationship was established between house price volatility and the macroeconomic determinants. It was further established that volatility itself, GDP and mortgage loans significantly determine house price volatility. In addition, a unidirectional causality from GDP and mortgage loans to house price volatility was found. The IRF analysis showed that shocks to the selected macroeconomic variables, except the prime lending rate magnify volatility. The VDC analysis also confirmed that mortgage loans and current volatility are the most significant variables that explain variation in house price volatility. Policymakers should, therefore, monitor macroeconomic factors closely and ensure that the economy is growing to mitigate the issues of house price volatility.

Keywords: House Price Volatility, Macroeconomic Determinants, Namibia

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF: Augmented Dickey-Fuller

AHP: Analytic Hierarchy Process

AIC: Akaike Information Criterion

APA: American Psychological Association

ARCH: Autoregressive Conditional Heteroskedasticity

BoN: Bank of Namibia

CUSUM: Cumulative Sum

CRDW: Cointegration Regression Durbin-Watson

DF: Dickey-Fuller

DW: Durbin-Watson

ECM: Error Correction Model

ECT: Error Correction Term

EGARCH: Exponential Generalized Autoregressive Conditional Heteroskedasticity

EVIEWS: Econometric views

FNB: First National Bank

FPE: Final Prediction Error

GARCH: Generalized Autoregressive Conditional Heteroskedasticity

GDP: Gross Domestic Product

GIRF: Generalized Impulse Response Function

HPI: House Price Index

HQ: Hannan-Quinn

IMF: International Monetary Fund

IRF: Impulse Response Function

JFE: Joint Facility for Electives

KPSS: Kwiatkowski-Phillips-Schmidt-Shin

LM: Lagrange Multiplier

LNGDP: Logarithm of Gross Domestic Product

LNML: Logarithm of Mortgage Loans

LNPLR: Logarithm of Prime Lending Rate

LNVOLTY: Logarithm of Volatility

LR: Likelihood Ratio

MSAs: Metropolitan Statistical Areas

NAMFISA: Namibia Financial Institutions Supervisory Authority

NSA: Namibian Statistics Agency

NUST: Namibia University of Science and Technology

OLS: Ordinary Least Squares

PP: Phillips and Perron

SIC: Schwarz Information Criterion

SWARCH: Switching Generalized Autoregressive Conditional Heteroskedasticity

TGARCH: Threshold Generalized Autoregressive Conditional Heteroskedasticity

UK: United Kingdom

UNAM: University of Namibia

VAR: Vector Autoregressive

VDC: Variance Decomposition

VEC: Vector Error Correction

VECM: Vector Error Correction Model

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DEDICATION

This work is dedicated to my living God, my father, my creator and my deliverer, for he has been with me throughout my studies. It was by his grace and mercy that everything worked out well for me as planned. Without him, I would not have reached this stage. It is also dedicated to my parents for supporting me emotionally and financially and pushing me to strive for what is best. The study is further dedicated to all those who believe in working hard to achieve their dreams.

DECLARATIONS

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Until the global financial crisis of 2007 which adversely affected housing among other markets, houses were viewed as a good investment because properties do not depreciate (Sunde & Muzindutsi, 2017). The importance of housing is evident from the various roles it plays in individuals' lives, the economy and society. Firstly, to individuals, housing is a basic need for shelter and forms an important part of their wealth. Secondly, it is an important segment of the economy because of its relation to other sectors such as construction, financial and retail. House prices are, however more volatile than other goods and services, because a house is the most demanded asset whereas real house prices' movements are greater than those of real incomes (Reen & Razali, 2016). Reen and Razali, (2016) stated that volatility is linked to lagged information and since house prices are unstable, any new information would cause volatility in prices. According to Boone and Girouard (as cited in Noord, 2005) supply shocks such as demographic labour supply changes and demand shocks that directly affects income are some of the factors that also contribute to house price volatility.

Some macroeconomic variables were also identified from the literature as determinants of house price volatility. For example, Akumu (2014) mentioned that movements in housing markets reflect wider changes in Gross Domestic Product (GDP), inflation, interest rates, demographics, mortgage loans, unemployment, money supply and income. Changes in these variables are hypothesized to have a close link to variations in house prices.

House prices can increase more than what economic fundamentals can support leading to a bubble in the property market (Pillaiyan, 2015). However, they cannot increase forever. The bubble will eventually burst leading to a severe fall in prices. For instance, many developed countries experienced a house price boom which was followed by a burst with real house prices falling by more than thirty percent in the late 1990s (Anundsen & Nymoen, 2013). This burst contributed to the world economic downturn after the Great Depression. According to Anundsen and Nymoen (2013), some countries experienced the highest unemployment rates, especially in the construction sectors, while the United States' housing market and financial system collapsed between 2007 and 2008. The collapse of the US financial system which resulted from a property bubble triggered the 2008 global financial crisis (Pillaiyan, 2015). This financial crisis proved that there is a close link between the housing market and the macro economy.

It should be noted that persistent house price volatility could spell danger for an economy. For one thing, Wang (2014) stressed that it might have implications for an economy as it has significant effects at a macroeconomic level. In the historical context, increasing house prices have been linked to increasing financial and real economic instability, whereas, financial and banking crises have been attributed to volatility in housing prices (Anundsen & Nymoen, 2013). From the households' point of view, not only does house price volatility force households to overextend themselves by buying more expensive houses, but it may also constraints labour mobility. For example, in the United Kingdom, about two million households were unable to move at the end of 2008 due to limited equity or lack thereof ("The Current Volatility in House Prices," 2011). Pettinger (2012) added that, in as much as rising house prices accumulate wealth for homeowners, it reduces living standards for people who do not own houses because it makes housing unaffordable. This makes it difficult to get home ownership especially when house prices increase more than incomes hence people who would have been able to afford houses in the past may be priced out of the market (Stephens, 2011). Moreover, house price inflation also creates generational inequality. For example, in the United Kingdom, older people who bought in the 1970s and 1980s managed to acquire cheaper housing as opposed to younger ones buying now (Pettinger, 2012).

In the Namibian context, Sunde and Muzindutsi (2017) stated that the rapid increase of house prices experienced over the years in Namibia may not be sustainable in the long run. Furthermore, International Monetary Fund experts predicted that there is a high possibility of a housing bubble burst and a financial crisis in Namibia if house prices continue to rise ("IMF fears housing", 2016). Although long-term solutions such as increased housing supply and short-term solutions such as taxation and safety nets are put in place to tackle volatility, there is still a need to investigate the sources of house price volatility for better planning. Hence, it is essential to analyse the determinants of house prices volatility in Namibia.

1.2 Statement of the Problem

Being the most demanded and valuable asset and due to its interactions with the entire economic cycle, the housing market may affect the economy through both wealth effects and its effects on other markets. Therefore, the risks associated with housing market fluctuations are more prevalent than other economic risks (Miller & Peng, 2004).

The uncertainty surrounding volatility in housing markets negatively affects stakeholders, mainly households. Nakajima (2011) stated that housing being the most critical component of households' wealth, changes in house prices significantly affect human lives since it impacts total wealth. For instance, a drop (rise) in the house price generates less (more) earnings for the owner. Moreover, due to affordability issues or flexibility reasons, many people resort to or prefer renting. However, Stephens (2011), cautioned that although private tenants may be less exposed to house price volatility than homeowners, they risk losing their accommodation if landlords are unable to repay mortgages when house prices fall.

Contrary to that, a rise in house prices has an impact on increasing rents as well (Pettinger, 2012). Expected regional house price and inflation differentials may also impede movement as individuals from low price areas may not afford to move to high price regions and vice versa for fear of not being able to return. Since mortgage debt is fixed in nominal terms, volatile prices may also be damaging to those who are unable to repay their mortgage due to circumstances beyond their control and would like to sell off their houses during downswings (Stephens, 2011).

Added to that, house price fluctuations may put financial systems at risk since it may impose a risk on the banking sector due to its high mortgage exposure, (Nakajima, 2011). This is because in most cases, houses are collateralised by the house itself hence may increase the spill-over effects between house prices and household borrowing. Besides, policymakers usually follow house price movements very closely when evaluating the financial system's vulnerability. Since the early 2000s, policymakers have increasingly used macroprudential tools such as loan-to-value-ratios to address a range of financial stability concerns, especially after the global financial crisis (Orsmond & Price, 2016). The focus for central banks has been to have tools in place that help identify and contain risk. The Bank of Namibia also implemented the loan-to-value (LTV) regulation in March 2017 in the hope of reducing the concentration of high exposure to mortgage loans (Mhunduru, 2017). The increase in house prices and mortgage loans in Namibia has raised questions as to whether or not the country is experiencing a housing bubble. Volatility may also make planning difficult as planners cannot be sure of what to expect and policymakers may be pressurised to make knee-jerk decisions (Nakajima, 2011).

A clear understanding of the macroeconomic drivers of house price volatility is essential in understanding and effectively managing the overall economy. This is because the housing market is linked to other sectors of the economy such as construction and financial sectors. Movements in the housing sector can trigger movements in other sectors, which would then impact the entire economy. The government should therefore closely monitor the housing sector since its proper management can help in managing the overall economy. While Matongela (2015) and Sunde & Muzindutsi (2017) have looked at the determinants of house prices, no study on volatility has been undertaken in Namibia yet. Hence, there is a need to address the current literature gap.

1.3 Objectives of the Study

The primary objective of this study is to analyse the macroeconomic determinants of house price volatility in Namibia. The specific objectives were:

- To analyse the house price volatility in Namibia.
- To analyse whether the prime lending rate, Gross Domestic Product (GDP) and mortgage loans determine house price volatility in Namibia;
- To evaluate the direction of causality between house price volatility and prime lending rate, Gross Domestic Product (GDP) and mortgage loans.

1.4 Research Hypotheses

In light of the above objectives, the following hypotheses were tested:

H_0: House prices are not volatile in Namibia.

H_0: Prime lending rate determines house price volatility in Namibia**;**

H_0: Gross Domestic Product (GDP) determines house price volatility in Namibia**;**

H_0: Mortgage loans do not determine house price volatility in Namibia**.**

H_0: There is no causal relationship between house price volatility and prime lending rate, in Namibia**;**

H_0: There is no causal relationship between house price volatility and GDP in Namibia.

H_0: There is no causal relationship between house price volatility and mortgage loans in Namibia**.**

1.5 Significance of the Study

This study is important because identifying the determinants of house prices volatility is crucial in examining the significance of house prices volatility in Namibia. Additionally, the findings of the study benefit various stakeholders of the housing sector including investors and policymakers. On the one hand, it can help investors in making informed decisions by being able to estimate the condition of the housing market with respect to price volatility, while it will help policymakers in the policy formulation process on the other hand. Specifically, the discovery that GDP and mortgage loans are significant determinants can help policymakers monitor these variables closely to reduce volatility risks. The study creates awareness for homeowners and other stakeholders by understanding the explosiveness of house prices, what the contributing factors are and what results to expect when there are shocks to the determinants. It also serves as a contribution to the existing literature and discussions on house price volatility and its determinants and can be a starting point for other people who would like to explore the topic further. As mentioned earlier, this study was undertaken due to the fact that although there are studies conducted on the determinants, no study has been carried out on house price volatility and its determinants in Namibia yet.

1.6 Limitation of the Study

The major limitation of the study is the unavailability of house price index's data for the period before 2007 as the First National Bank (FNB) only started computing it in that year. There is also no monthly GDP data since the Namibian Statistics Agency (NSA) only captures GDP values on a quarterly basis and this limited the number of observations. Additionally, analysing volatility requires very high-frequency data, but there is a lack of this type of data for most variables in the Namibian economy. The lack of high-frequency data could have had implications on the interpretation of results. The study focused on the macroeconomic determinants of house price volatility, but although there are many determinants, only three, namely, the prime lending rate, GDP and mortgage loans were employed. Inflation, for example, was excluded from the model since there is a possibility of a high correlation between it and the interest rates. The study was also limited in scope due to the fact that the topic of house price volatility has not been studied in the Namibian context.

1.7 Delimitation of the Study

The study focused on the overall market house prices because some of the chosen variables are only computed for the entire nation and not for individual towns. Additionally, it specifically analysed house price volatility, since other researchers have covered subjects such as demand for housing and determinants of house prices in Namibia. In addition, only the Namibian housing market was covered since the researcher is a Namibian and has a better understanding of the market.

1.8 Organization of the Study

The rest of the study is organised as follows: Chapter two discusses the overview of house price volatility and its determinants by looking at their trends over the years. Chapter three explores both the theoretical literature in which three theories namely theory of the user costs of housing and rents, the bubble theory and the Tobin's Q theory are discussed. It further discusses the empirical literature on the drivers of house prices in general and those of house price volatility. Chapter four explains the models employed to answer the study's objectives and details all the steps followed. The conceptual framework explaining the expected relationships between house price volatility and its determinants is also discussed in this chapter. The study's findings are discussed in chapter 5, and chapter 6 gives the main conclusions and policy recommendations.

CHAPTER TWO: AN OVERVIEW OF HOUSE PRICES AND MACROECONOMIC VARIABLES IN NAMIBIA

2.1 Introduction

This chapter presents an overview of house prices and the identified macroeconomic variables in Namibia. It analyses trends of the variables of interest through the use of graphs in order to contextualize the study's discussions and findings. It is divided into three sections of which section 2.2 gives a general background of how the Namibian housing market has been performing over the years in terms of house prices. The section further discusses the movements' ofthe prime lending rate, GDP and mortgage loans which were used as independent variables, while section 2.3 concludes the chapter.

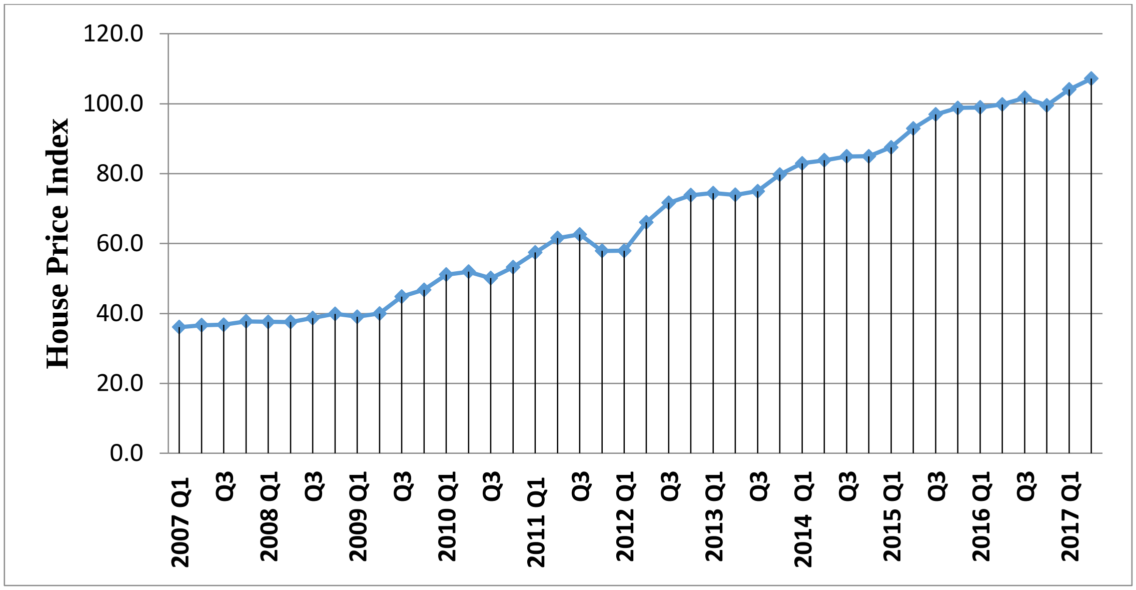
2.2 An Overview of Housing Market and the Macroeconomic Variables in Namibia

2.2.1 House Price Index (HPI) Trend in Namibia

Prices in the Namibian housing market have been volatile over the years (Sunde & Muzindutsi, 2017). Grobler (as cited in Sunde & Muzindutsi, 2017) noted that on average, up until 2014 house prices have increased by 29 percent annually implying that the housing market may become unsustainable in the long run. This increase can be confirmed by the upward trend in the house price index from 2007 to 2014 as depicted in figure 2.2.1. Furthermore, statistics have shown that the house price index increased by 8.2, 8.5 and 7.2 percent in the central, coastal and northern regions respectively in June 2009 (First National Bank, 2009). However, the southern region's index remained subdued during that month due to downward pressure on small and medium houses. Likewise, the housing index fell by 4.5 percent as house prices weakened in the central and coastal property markets in February 2012 as it can again be observed from figure 2.2.1 (FNB, 2012), while it fell by 5.7 percent in March 2013 thereby putting house prices under pressure (FNB, 2013). Towards the end of the third quarter of 2015, property prices rose sharply, with the central region recording an increase of 27 percent and an average price of N$1.9 million (FNB, 2015). The coastal region experienced an increase of 12 percent, and an average price of N$975,000.00 was recorded by the end of September 2015, whereas the northern regions recorded an overall house prices increase of 22 percent.

However, there was a downturn in the property market, especially in Windhoek between 2015 and 2016 due to the Angolan economic crisis that was caused by a plunge in global oil prices (Nakashole, 2016). Most flats in areas such as Hochland Park, Windhoek North and West; and Dorado Park were empty as the Angolan tenants moved to cheaper places in Katutura. Contrary to that, the central region prices tripled during the second quarter of 2016 while those of the coast and north doubled (FNB, 2016). Although house prices in the coastal region continued to increase in the fourth quarter of 2016, they reduced in the central region. Given the economic situation and inability of citizens to afford, prices were expected to go down by the end of 2017 (FNB, 2016).

Figure 2.2.1: The House Price Index Trend



Source: Author's computation using the FNB house price index

2.2.2 Prime Lending Rate Trend in Namibia

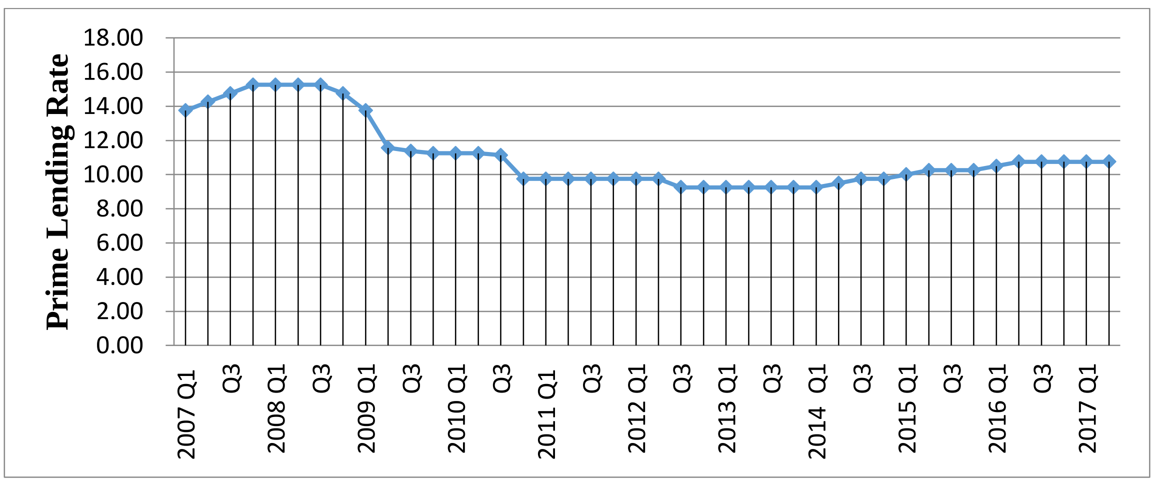
Figure 2.2.2 shows movements in the prime lending rate for the period 2007-2017. The figure shows that the prime lending rate has not been stable over the years. To begin with, due to a directive by the Bank of Namibia to reduce interest rates to meet its demand for lower interest rate spread, Bank Windhoek complied by reducing its prime lending rate by 50 basis points to 10,75 percent on 5th July 2010 (Duddy, 2010). Other banks also followed suit and the overall reduction was said to have increased borrowing during that period. This act was deemed necessary for economic development.

Following an announcement by Bank of Namibia to increase its repo rate, commercial banks also raised their lending rates in 2014. Specifically, both the First National Bank and Nedbank increased their prime rates by 0.25 to 9.75 percent per annum (Kaira, 2014).

It was reported that due to this increase, the overall market prime rate was 0.5 percent higher than that of South Africa.

According to the Bank of Namibia (BoN) and the Namibia Financial Institutions Supervisory Authority (NAMFISA), (2017), the downgrade of the Namibian outlook by credit rating agencies from stable to negative in 2017 implied that the country could lose its investment grade status. This was one of the factors that could have had triggered a rise in the general interest rates. Nevertheless, the central bank reduced its lending rate by 25 basis points to 6.5 percent to align it to that of South Africa in August 2017, and commercial banks followed suit by lowering their prime lending rates, (Jantze, 2017). This means the overall Namibian prime lending rate reduced by the end of 2017.

Figure 2.2.2: The Prime Lending Rate Trend



Source: Author's Computation using the BoN prime lending rate

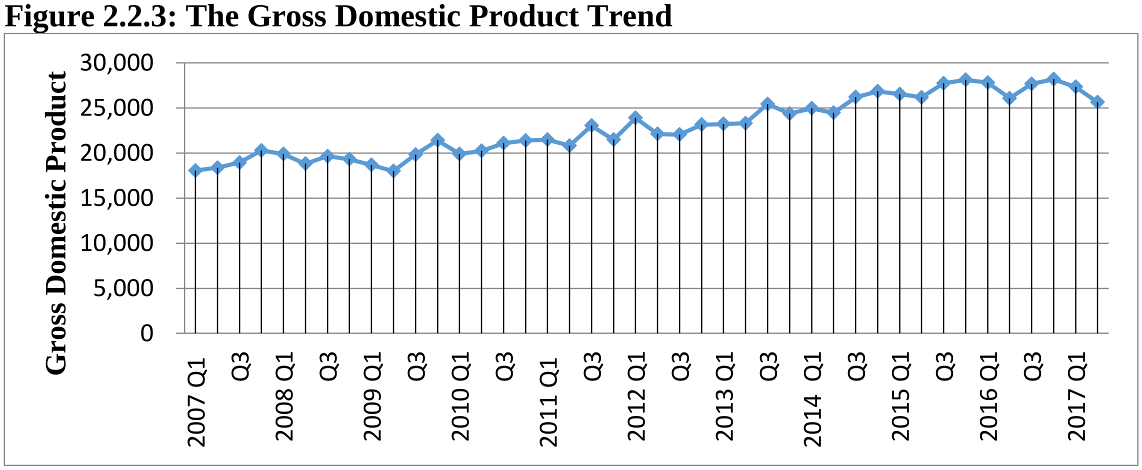
2.2.3 Gross Domestic Product Trend in Namibia

Being a middle-income country, Namibia has successfully managed to build a market-oriented economy and stable political environment over the years. This has contributed significantly to the country's economic growth as evident from figure 2.2.3 that is showing a growing trend of GDP. Real output averaged at 4.5 percent between 2003 and 2007 (International Monetary Fund, 2007). Expansions in some of the leading sectors such as construction, mining, transport and communications were said to be behind the growth during that period. Although there was a positive growth rate of 4.3 percent in 2008, the economy faced a recession contracting by 0.7 percent in 2009 following the global economic downturn (Ministry of Finance, 2011). As a result of the global economic recession and consequent fall in demand for and prices of commodities, primary industries experienced a decline. According to the Ministry of Finance (2011), there was a recovery in 2010 with an estimated growth rate of 4.8 percent in GDP which was attributed to an increase in the mining of diamond and uranium.

There was fear that the agriculture sector which is one of the most significant contributors to overall GDP would not recuperate well if weather conditions did not improve. Drops in electricity supply from South Africa and the fall of Angolan oil prices were also threatening factors to Namibia's growth. Furthermore, Bank of Namibia and NAMFISA (2016) confirmed that there was indeed a fall in the agriculture sector due to the drought that the country experienced in 2015. Despite the prevalent drought conditions and volatile exchange rates among other risk, the overall outlook for economic activities still looked promising. Although the Bank of Namibia (2015) cautioned that the economy faced a risk of a fall in economic growth due to low trade prices for mine products and bad weather conditions, the real GDP growth rates were recorded at 6.1 and 0.7 percent during 2015 and 2016 respectively (Namibia Statistics Agency, 2017). The growth came as a result of improved performances in both the secondary and treasury sectors joined by a recovery of the primary industry. To be specific, it was reported that growth in private and public construction sectors, a rise in manufacturing output due to new entries and increased electricity production were behind the medium-term growth of GDP for 2015/16.

As depicted in figure 2.2.3 below, real GDP grew slowly during 2016 at a rate of 0.7 percent as opposed to the 6.1 percent growth rate achieved in 2015. This according to BoN and NAMFISA (2017) was a result of contractions in construction and mining sectors, as well as the fiscal consolidation in the public sector (Bank of Namibia & NAMFISA, 2017). The economy, however, contracted in 2017 with the real GDP growth rate falling by 0.8 percent. This according to the Namibia Statistics Agency (2017) was attributed to the weak performance in the secondary and tertiary sectors.

Figure 2.2.3: The Gross Domestic Product Trend



Source: Author's computation using figures from NSA

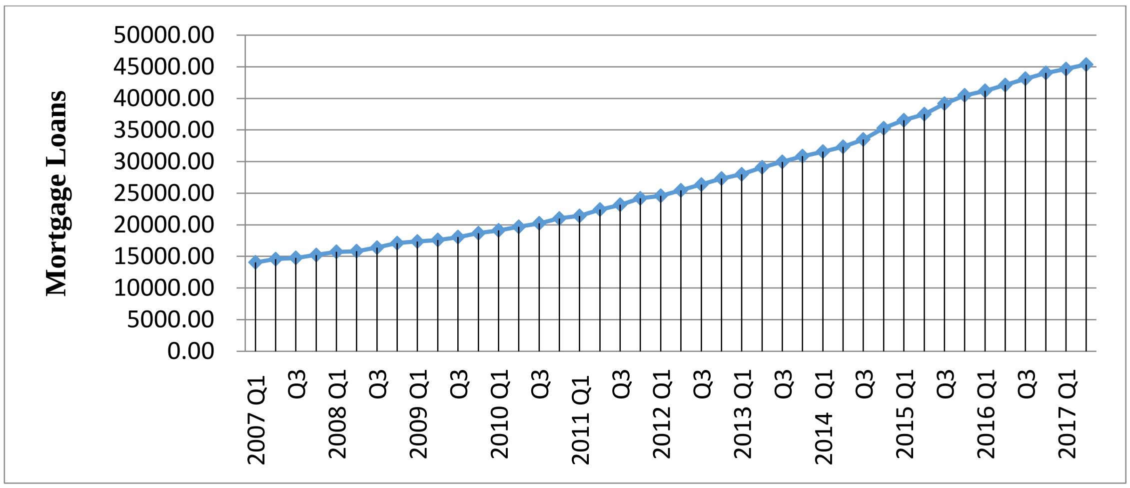
2.2.4 Mortgage Loans' Trend in Namibia

Namibia is considered one of the countries with a very strong housing finance system and has a mature banking system. According to FinMark Trust (2011), the country has a well-functioning infrastructure to facilitate mortgage lending hence takes the 5th position out of six in terms of the World Bank's depth of credit information index. Mushendami and Kandume (2008) mentioned that the Namibian housing finance has been growing over the years, with mortgage loans taking the biggest chunk of bank loans in Namibia. For instance, mortgage loans covered 52.6 percent (N$14.0 billion) of the total loans by December 2007, whereas a total of N$15.2 billion which is 32 percent of GDP was outstanding for the rest of that financial year. 92.2 percent of the total mortgage loans was financed by banking institutions, while the remainder was funded by Agribank and the National Housing Enterprise (Mushendami & Kandume, 2008).

Mortgage loans represent the most significant form of home financing in Namibia. According to Sunde and Muzindutsi (2017), about 800 000 households lived in debt in 2015 with mortgage loans taking the biggest portion. Bank of Namibia and NAMFISA (2016) explained that this led to overall mortgage loans increasing by 0.5 percent to 12.5 percent in 2015 from 12.0 percent of 2014. Mortgage lending growth, however, fell to 9.5 at the end of 2016 but together with non-performing loans increased again by N$120.6 million in 2017 (BoN and NAMFISA, 2017).

Additionally, mortgage loans on average grew by 8.1 percent on an annual basis and a total of N$ 47.5 billion was recorded in 2017 of which N$36.2 billion was for the residential sector (Ngatjiheue, 2018). It was explained that mortgage loans given for residential purposes accounted for 76.2 percent of the total extended to the private sector and the remainder was for the business sector. Figure 2.2.4 confirms that mortgage loans exhibit an upward trend from 2007 quarter 1 to 2017 quarter two as demand for it increased.

Figure 2.2.4: Mortgage Loans' Trend



Source: Author's computation using figures from BoN

2.3 Conclusion

By way of conclusion, chapter two presented an overview of the Namibian housing market and the identified macroeconomic variables. To be specific, it looked at the trends of the variables of interest being the house price index, prime lending rate, Gross Domestic Product and mortgage loans. Firstly, it was mentioned that the house price index and prime lending rates have not been stable over the years and it is evident from figure 2.2.1 and 2.2.2 above. Secondly, the overall performance of Namibia in terms of economic growth was said to be impressive although certain hiccups led to a fall in GDP during some years.

Lastly, mortgage loans which take the largest share of total household debt have been increasing over the years due to people's appetite for housing.

CHAPTER THREE: LITERATURE REVIEW

3.1 Introduction

This chapter presents a review of the theories related to the study and empirical studies conducted on the drivers of house prices in general and those of house price volatility. The rest of the chapter is structured as follows: section 3.2 discusses three theories related to housing price determinants namely theory of the user costs of housing and rents, the bubble theory and Tobin's Q theory. Section 3.3 reviews empirical studies done by other researchers by looking at the models used, periods covered and the main findings, whereas section 3.4 summarises the chapter discussions.

3.2 Theoretical Literature

3.2.1 Theory of the User Costs of Housing and Rents

Keynes introduced the User costs' concept in his writing called the "General Theory" that was published in 1936. Keynes (1936) stated that user cost is simply the equivalent of the current disinvestment involved in using equipment. They can also be defined as the expenses borne by owners of assets resulting when the asset is used for a given period. When taking it form the housing point of view, user costs can be defined as the annual costs that home purchasers of homes incur when they buy new houses, utilise them for one period and sell them at the end of that period (Nakajima, 2011). The theory explains how user costs are established and its relation to rents (Nakajima, 2011). These costs include interest cost, property taxes, deduction of mortgage interest payments, maintenance and repair costs, and expectations about future changes in house prices.

It is theorised that market rental costs for an identical home are expected to be equal to their ex-ante user cost, ceteris paribus, (Garner & Verbrugge 2009). However, Verbrugge (2008) emphasised that not only are housing rents far less volatile than ex-ante user costs, but they may also deviate for extended periods of time. Hence, according to Verburgge (2008), a standard annual user cost formula which excludes special tax treatment given to homeowners may be given as follows:

$$\mathbf{U_t = P_t^h (i_t + \gamma - E\pi_t^h)}$$

Where P_t^h denotes home price, i_t denotes nominal interest rate, γ includes maintenance and repair, depreciation, insurance and property tax rates which are all assumed constant. Whereas π_t is the four-quarter constant-quality home price appreciation between the current and next period and E denotes expectations.

The user cost components can be used to understand house price dynamics by incorporating the aspect of user cost equivalence to rent (Verburgge, 2008). For instance, if user costs and rents are initially the same, but interest rates rise, total user cost will rise as well assuming all else is equal. The rise in user costs (greater than rent) forces homeowners to sell their houses as owning them becomes expensive. This reduces overall demand for housing which further exerts downward pressure on house prices. Hence house prices and user costs would eventually return to their equilibrium level, while user costs and rents will be equalised with a higher interest rate and lower house prices. Contrary to that, when rents are higher than user costs, the demand for housing would rise and in turn push house prices up. House prices would go up until user costs and rents are equalised.

As aforementioned, user costs and rents are expected to be equal when houses are rented and purchased. This is because if rent exceeds the costs of owning and maintaining a house, people will find it profitable to buy houses and rent them out Nakajima (2011). When this happens, demand is expected to increase thereby pushing house prices up, and the opposite holds if rent is lower than user costs. It can then be stated that user costs and house prices move in the same direction, i.e. user cost components will be larger if house prices are higher, (Garner &Verbrugge 2009).

In a nutshell, house prices are low when rents are low, interest rates are higher, property tax rates are higher, the tax deduction rate is lower, maintenance and repair costs are higher, and house prices are expected to decline in the future, ceteris paribus (Nakajima, 2011). Based on the above background, the study adopts the user cost theory to support the thesis. As aforementioned, house prices and these costs move in the same direction, i.e. when user costs are larger, house prices would also be higher and vice versa. Hence the adoption of the theory to test the notion that a change in interest, for example, can influence house prices.

3.2.2 The Bubble Theory

One of the first individuals to make a theoretical effort to understand bubbles was Keynes (1936), who mentioned that bubbles could form if investors were not acting rationally. Keynes (1936) admitted the possible occurrence of speculative bubbles. Opponents of Keynes, however, argued that bubbles could still form even if investors were rational due to changes in technology and population that continuously change the economy

(Halldorsson, 2016). Higher consumption of goods may also cause a rise in prices. Additionally, Friedman (1953) tended towards the view that bubbles cannot form as rational speculators would always stabilise prices and careful investors will not allow bubbles to develop.

Sjoling (2012) defines a bubble as a sharp rise in house value that is followed by an equal fall in value. However, the time between rise and fall in prices should not be longer than two years for it to qualify as a bubble. Lind (as cited in Sjoling, 2012) explained that, if the time lag between the increase and decrease is longer, it will imply that the same factors did not influence the two events. In other words, it indicates a rapid increase in house prices in a year for consecutive years and eventually falls just as rapidly in the following years (Mayer, 2011). The literature has indicated numerous explanations of what may cause a bubble. For instance, Case and Shiller (2004) stated that a bubble occurs when excessive public expectations regarding a rise in future prices trigger a temporary rise in current prices. However, Mayer (2011) suggested that a bubble results when house prices are extremely volatile over the cycle, increasing more than fundamentals would suggest in a boom and falling faster than the decline in fundamentals in a recession.

Based on their intensity and influence on the overall economy, bubbles can be classified into three types namely the good, bad and ugly bubble (Duus & Hjelmeland, 2013). Firstly, the good type is the least harmful and considered a healthy bubble since it has a little adverse effect on households' demand for consumer goods and has minimal effects on the economy. The latter is more common in speculative and financial assets. Secondly, the bad type influences the general economy and private households to a certain degree and is common in stock markets. Thus, impacts of a burst would be felt more by investors and shareholders rather than the society in general. Lastly, an ugly bubble is the most aggressive type, and a burst adversely affects the entire economy. It results when real assets such as housing are overvalued (Duus & Hjelmeland, 2013). Losses from a burst are mostly felt by banks and credit systems, but may spread to firms and households as the banking system weakens, interest rates rise, and lending policies become stricter. In an ugly bubble, assets depreciate rapidly, and owners lose out immensely and given their illiquid characteristic, individuals may find it difficult to exit the market.

Due to the high transaction costs, illiquidity and heterogeneity aspects of the housing market, a housing bubble influence on the economy can be greater than that of a collapse in the stock market (Chen, Gan, Hu & Cohen, 2013). As aforesaid, the housing market plays a great role in any economy due to its relation to other markets. In this light, a house bubble affects the overall economy and a bubble burst can consequently be followed by a financial crisis (Duus & Hjelmeland, 2013).

When there is a bubble in the housing market, demand increases as buyers view a house that may normally seem expensive to be cheaper due to the gain they expect from increased house value (Case & Shiller, 2004). Economists have pointed out that when prices start rising, players in the housing market become too excited and get carried away, thereby causing house prices to spike in booms (Mayer, 2011). Additionally, when the perception in the economy is that prices will rise in future, it is favourable for new buyers to buy now than later when houses are more expensive (Sjoling, 2012). However, it is impossible for prices to rise persistently (Case & Shiiller, 2004). When home investors notice that prices will eventually decrease, demand would fall and therefore house prices. This fall in prices after a sharp price is what is called a bubble bursts and it discourages sellers from selling houses while owners may lose confidence in the value of their homes (Sjoling, 2012).

There is evidence of aspects of a housing price bubble in the world. For instance, rapid price increases were experienced during the 2000s in all developed nations apart from Germany and Japan (Case & Shiller, 2004). This problem has also been experienced in developing countries including Namibia. Sunde and Muzindutsi (2017) stated that the rapid increase of house prices experienced over the years in Namibia may not be sustainable in the long run. Furthermore, International Monetary Fund experts predicted that there is a high possibility of a housing bubble burst and a financial crisis in Namibia if house prices continue to rise ("IMF Fears Housing", 2016). Since housing is one of the most demanded assets in Namibia, it is worrisome that the country could face an ugly bubble burst if house prices continue to be overvalued. As aforementioned, the Namibian financial system, firms, household and the entire economy could be adversely affected should the government fail to stabilise housing prices.

3.2.3 Tobin's Q Theory

The Q-theory, developed by James Tobin in 1969 is an extension to the neoclassical investment theory which assumes that rational market players will continue to invest if the net present value remains positive (Duus & Hjelmeland, 2013). It examines the link between the market price and replacement costs of an asset. The theory states that it is valuable to invest in construction when the market price of an asset is higher than the replacement cost and worthless to do so when the opposite is the case. According to Gathuru (2012), it is based on the notion that investment in housing is influenced by consumer's arbitrage between new and existing homes. Demand for new homes relative to existing ones may, for example, be presumed to rise if new homes are cheaper. Thus, suppliers would respond by building new homes. The Tobin's Q can be computed as follows:

$$\text{Tobin's Q} = \frac{\text{Market Price}}{\text{Replacement Cost}}$$

Tobin's Q is based on the marginal q, but the above equation shows the average which is mostly applied in empirical studies as the marginal q is not directly observable. Hayashi (as cited in Duus & Hjelmeland, 2013) defines the marginal q as the market value of an additional unit of capital to its replacement cost whereas the average q is the market value of an existing unit of capital to its replacement cost. Usually, the average and marginal q would be the same when certain assumptions are fulfilled (Duus & Hjelmeland, 2013). The assumptions are that suppliers in the market are price takers, the production function and installation function are linear homogeneous and have constant returns to scale and that capital markets are perfect. When the investment level rises, the marginal q falls.

When applying the Q-theory to housing market analysis, the market price becomes the value at which a house is sold whereas the replacement cost is the total construction cost (Duus & Hjelmeland, 2013). Moreover, the theory signals the state of the housing market

(Berg and Berger, 2005). A Q-value is less or greater than one indicates excess supply of or demand for houses respectively, while that of one signal an equilibrium in the market. When the q-value is above 1, rational players in the market will find it profitable to undertake more investments (Berg & Berger, 2005). As mentioned above, a q value of one indicates a long-term market equilibrium. According to Brueggemann and Fischer (as cited in Duus & Hjelmeland, 2013), this merely means that buyers will not be willing to buy houses at a price higher than the replacement cost.

A high q value indicates an increase in the supply of housing due to a rise in investment and this may exert downward pressure on the market price of existing houses in the long run. It should, however, be noted that if q is persistently high, it shows that market prices are above their fundamental value, therefore, signals the presence of a bubble in the housing market (Duus & Hjelmeland, 2013).

Opponents of the theory have criticised that the market value of the firm may be easy to determine, but the exact replacement cost may not be especially for goods in secondary markets. Furthermore, it may be challenging to evaluate intangible assets, and the q ratio cannot be used to make investment decisions.

3.3 Empirical Literature

The housing market has interested some scholars due to the role it plays in the economy. The economic literature has explored various aspects of the housing market, with some scholars looking at the macroeconomic determinants of house price volatility while others looked at the determinants of house prices. The following sub-sections discuss empirical views on the macroeconomic determinants of house price volatility, macroeconomic determinants of house prices in general and the determinants of house prices in Namibia.

3.3.1 Empirical Literature on House Price Volatility and its Macroeconomic Determinants

Despite the importance of the housing market, the area of sources of house price volatility has received little attention in the literature. Existing empirical studies in the literature have used different data, variables, and methodologies to examine the determinants of house price volatility that have produced mixed results. Among the few scholars that addressed house price volatility and its macroeconomic determinants are: Miller and Peng (2004); Lee (2009); Hossain and Latif (2009); Tu and Zhou (2015); Reen and Razali (2016); and Tupenaite, Kanapeckiene and Naimavicience (2017)). To begin with, studies by Miller and Peng (2004); Hossain and Latif (2009), and Tu and Zhou (2015) all found evidence of house price volatility and agreed that the volatility was significantly affected by both positive and negative house price appreciations. Miller and Peng (2004) emphasised that an exogenous increase (decrease) in the home appreciation rate magnifies (mitigates) the volatility. While Hossain and Latif (2009) found the population growth rate to be an insignificant determinant, Lee (2009) and Tu and Zhou (2015) found it to be significant, implying that changes in the population growth rate can result in house price volatility change. However, the findings of Miller and Peng (2004) showed that the impact of population growth rate was complicated as it depended on qualitative characteristics of the change.

Another study by Lee (2009) also concluded that house prices where indeed volatile. The author stated that shocks to inflation produced dynamic responses in housing prices. This result supported some studies in housing price volatility that inflation is one of the most significant determinants of housing price volatility including Hossain and Latif (2009); Reen and Razali (2016); and Tupenaite, Kanapeckiene and Naimavicience (2017). Lee (2009) also documented that past values of unemployment and income growth rates were the other determinants of house price volatility of which the unemployment rate had a negative impact while income growth had a positive impact. The negative impact of the unemployment rate was also shown in Tupenaite, Kanapeckiene and Naimavicience (2017).

The level of Gross Domestic Product (GDP) in a country can indirectly measure living standards as it determines GDP per capita. When incomes are high, citizens are more able to afford housing and vice versa. Hence, the level of GDP in a country can affect the rate at which house prices fluctuate. Some studies in the literature found that changes in the Gross Domestic Product (GDP) significantly affected housing prices volatility. Specifically, Hossain and Latif (2009); Reen and Razali (2016); and Tupenaite, Kanapeckiene and Naimavicience (2017) were some of the scholars who found GDP to be a significant determinant. Hossain and Latif (2009) explained that positive changes in the GDP growth rate magnify volatility, while negative changes mitigate it.

When it comes to the lending rate, it is hypothesised that it plays a significant role in any economy as it the cost of borrowing. Both central and commercial banks charge interest when lending money. Usually, the rate set by central banks affects all other lending rates in the financial system. Likewise, many people take out home loans which are paid back with interest because they are financially constrained. Hence, there is no doubt that mortgage loans and lending rates influence house prices. Although Lee (2009) found that mortgage rates had little influence on housing price volatility, studies of Reen and Razali (2016) and Tupenaite, Kanapeckiene and Naimavicience (2017) identified interest rates as a significant determinant. In addition, the findings of Tupenaite, Kanapeckiene and Naimavicience (2017) further showed that mortgage loans significantly affect volatility. Other macroeconomic determinants such as house sales growth rate, house price volatility itself and housing stock were documented in the studies of Miller and Peng (2004); Tu and Zhou (2015) and, Reen and Razali (2016) respectively.

Savva and Michail (2017) estimated the dynamics of the housing market price change volatility in Cyprus and found a high and low volatility states existed in the market, and both states showed a high degree of persistence. The high volatility state's probability was close to one in the beginning but eventually declined around 2008-2010 when the Cypriot housing boom was at the peak. The implication was that booms could be re-enforcing because of the degree of persistence. It was further discussed that higher volatility was a result of increased credit, suggesting that credit expansion attracts investors to the housing market thereby increase speculations.

Contrary to the above, other scholars only examined the dynamics of house prices without identifying the sources. For example, Tsai and Chen (n.d.) found at least two volatility states in the price series suggesting that housing markets are relatively stable and different states do not switch very often in the United Kingdom (UK). The study further discovered that the degree of high price volatility was as high as 4.89 times of low volatility for all housing market and 2.87 times of low volatility for new housing markets. It was however concluded that low volatility was the normal condition in the two markets.

The above empirical literature shows mixed findings by different scholars. Table 3.3.1 summarises the samples covered, countries studied, and the methodologies followed in the studies discussed above that might have led to different findings.

Table 3.3.1: Sample, Country and Methodologies Used by Various Scholars

Author(s)	Sample and Country	Model
Tsai and Chen (n.d)	1955 – 2005 (UK)	ARCH, GARCH and Switching ARCH (SWARCH)
Miller and Peng (2004)	1990 Q3 – 2002 Q2 (United States of America)	GARCH and Panel VAR
Hossain and Latif (2009)	1981 Q1- 2006 Q1 (Canada)	GARCH and VAR
Lee (2009)	1987 Q4 – 2007 Q4 (Australia)	Exponential GARCH (EGARCH)
Tu and Zhou (2015)	1980 Q2 -2014 Q1 (Canada)	ARCH, GARCH, Threshold GARCH (TGARCH) and VAR
Reen and Razali (2016)	2005 Q1 – 2013 Q4 (Malaysia)	ARCH
Savva and Michail (2017)	2001 Q1 – 2016 Q2 (Cyprus)	ARCH and SWARCH
Tupenaite, Kanapeckiene and Naimavicience (2017)	2005 – 2015 (Lithuania)	Analytic Hierarchy Process (AHP)

Source: Author's Compilation

3.3.2 The Macroeconomic Determinants of House Prices

It is hypothesised that house prices have various characteristics and respond to different factors and this aspect of the housing market has received much attention. Mainly, various scholars in the literature have studied the macroeconomic drivers of house prices. This section discusses a few of these studies and their findings.

Firstly, Borowiecki (2009) studied the determinants of house prices and construction activity in Swiss using annual data for 1991-2007. The Vector Autoregressive (VAR) model analysis discovered that real house price growth and construction activity dynamics are mostly influenced by changes in population and construction prices, while real GDP had a minor impact in the short run. Furthermore, the study found that shocks to house prices only had short-term impacts on housing supply and vice versa. Finally, it was discussed that despite substantial price increases, there were no worries of overvaluation. Secondly, Mwenje (2015) examined vital macroeconomic variables that influence housing prices in South Africa. Impact of shocks to macroeconomic variables on housing prices in the short run and the nature of the relationship, in the long run, were studied within the VECM framework. Using quarterly data for the period 1978-2014, the study found that real house prices, exchange rate, new mortgage loans and prime interest rates had a long run equilibrium relationship. Household net wealth and household debt were found to be the leading variables explaining variations in house price. While shocks to prime interest rates and Rand/US$ exchange rate showed a negative impact on house prices in the short run.

In Malaysia, Pillaiyan (2015) investigated the vital macroeconomic drivers of house prices. Using the VECM technique, inflation, stock market, money supply (M3) and a number of approved residential loans were confirmed to be significantly related to the

Malaysian housing prices. Gross Domestic Product was not recognised as a determining factor.

Finally, Kim, Mei, Yin and Niap (2016) also examined the fundamental determinants of housing price in Malaysia. Their study employed the Error Correction Model (ECM) over the period 2000 quarter 1 to 2014 quarter 4. It was found that unemployment had a negative relationship, while real GDP had a positive relationship and the lending rate had no significant relationship with Malaysia housing prices in the short run. However, the results further showed that lending rates and house prices were negatively related in the long run.

3.3.3 The Namibian Housing Market and the Determinants of House Prices

In the Namibian context, a few researchers have analysed the housing market. In the first place, Matongela (2015) analysed the determinants of house prices in Namibia for the period 2007-2013 using cointegration and error correction modelling. Land supply was found to be a significant determinant of house prices. The study concluded that house prices' increase during the reviewed period was due to a serviced land shortage in Namibia.

Kgobetsi (2017) looked at the factors influencing housing affordability for the low and middle-income households in Windhoek, Namibia. The author also reviewed how various government policies such as the Namibian National housing policy (formulated and adopted in 1991 and reviewed in 2009) that guides the actions of various stakeholders with regard to the development, provision and financing of housing and the Local Authorities Act of 1992 which Provides powers to the local Authorities to engage in housing schemes which include providing loans and availing affordable serviced land and establish a housing fund, have influenced the Namibian housing market. Using a mixed research strategy which involved a close review of the literature and interviews with selected income groups, it was found that social, economic and political factors influence housing affordability in Windhoek. These factors included immigration, education levels, income, taxation, interest rates, preference, construction cost and availability of serviced land. Moreover, the results highlighted that most people were not aware of some existing policies and that the policies have not been effective as house prices remained high in Namibia. It is, however, worth noting that in 2007, the Bank of Namibia warned against high house prices in Namibia as it could trigger high inflation.

Lastly, Sunde and Muzindutsi (2017) conducted an econometric analysis of endogenous and exogenous determinants of house prices and new construction activity in Namibia for the period 2000-2014. The study employed a restricted VAR model with a Johansen cointegration approach for analysis. The authors also analysed if there was evidence of an overvaluation of house prices to determine if there was a chance of a housing price bubble. The findings established that the Namibian housing price index was significantly affected by changes in population, mortgage loans and inflation, while house price index and inflation were the significant determinants of construction activities. Moreover, the study found bidirectional causality between the house price index and new construction activity. It was then concluded that there is evidence of overvaluation of house prices which could result in a house price bubble.

3.4 Conclusion

Chapter three discussed both theoretical and empirical views concerning factors influencing changes in house prices and house price volatility. The user cost theory stated that changes in user costs have an impact on house prices. According to the bubble theory, highly volatile house prices are often sources of house price bubbles. Additionally, it was mentioned that the Tobin Q's theory explains the relationship between market prices and replacement costs of an asset. Finally, most empirical studies presented similar views on what influences house price fluctuations and it was observed that the same macroeconomic fundamentals drive house prices and house price volatility.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Research Design

There are various types of research designs of which the appropriate type depends on the nature of the research objectives or questions (Walliman, 2011). To analyse house price volatility, and its determinants in Namibia the study employed a quantitative research design since it involved an econometric modelling. A quantitative research method follows a numeric or statistical approach to research design approach. Since they build on existing theories, quantitative studies are specific in their surveying and experimentations, (Williams, 2007). Moreover, this approach allows for objectivity, and results can be predictive, explanatory and confirming. The study made use of time series data which was analysed using the Econometrics Views (Eviews) software.

4.2 Procedure

The study used secondary quarterly time series data for the period January 2007 quarter one to 2017 quarter two, yielding a total of 42 observations. The sample period was chosen based on the availability of data for the primary variable of interest, house price index. The FNB only began keeping records of the overall market housing price index in 2007 and has only recorded an index based on FNB home loans and not the aggregate house price index before that year.

The house price index volatility was used as the regressand, whereas the determinants identified from the literature were regressors. These determinants are interest rates, GDP and mortgage loans. Secondary data for the house price index and GDP at market prices was sourced from First National Bank of Namibia (FNB) and Namibian Statistics Agency (NSA) respectively. Moreover, data for mortgage loans and the prime lending which was used as a proxy for interest rates was acquired from Bank of Namibia. All variables were transformed into natural logarithms so that the data could meet statistical interpretations of the study more closely. Table 4.2 specifies the measurements and definitions of the variables used.

Table 4.2 Measurement and definition of variables

Dependent Variable	**Measurement**	**Definition**
House Price Volatility	House price Index volatility series (GARCH variance series)	Logged Quarterly house price index (percentage)
Independent Variables		
Interest Rates	Aggregate Prime Lending Rate	Logged quarterly figures of the prime lending rate (percentage)
Gross Domestic Product	Real GDP	Logged quarterly GDP at market prices figures (millions)
Mortgage Loans	Aggregate Nominal Mortgage Credit	Logged quarterly nominal mortgage credit figures (millions)

Source: Author's compilation

4.3 Conceptual framework explaining the determinants of house prices in general and house price volatility

Some macroeconomic variables have been identified from the literature as determinants of house prices in general and house price volatility. It is hypothesised that house prices, in general, are influenced by macroeconomic variables as well as the fundamentals of demand and supply. On the supply side, some researchers have reasoned that unavailability of land and time taken to build a house could be some of the contributing factors, while others concluded that prices respond to unstable land and building materials' prices and macroeconomic fundamentals. Nakajima (2011) also noted that changes in demographic factors indirectly affect house prices through demand and that housing demand increases when income is more volatile and therefore increases house prices volatility. However, for this study, three variables, namely GDP, prime lending rate and mortgage loans were chosen as determinants. It is hypothesszed that changes in these variables have a close link to variations in house prices. Figure 4.3 demonstrates these determinants of house price volatility on which the analysis of the study is be based.

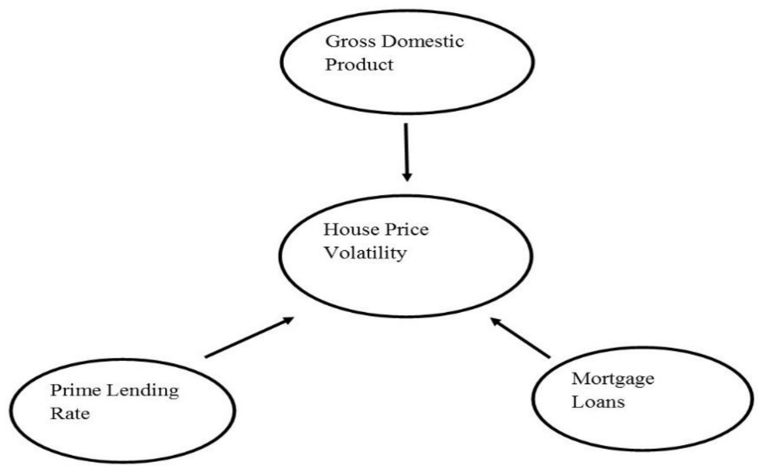
Firstly, it is widely recognised that GDP, which is a measure of economic growth is the primary driver of house prices (Pillaiyan, 2015). According to Akumu (2014), there is a positive relationship between house prices and GDP in a sense that if GDP increases, it should be expected that there would be a rise in demand for housing which in turn pushes house prices up, ceteris paribus. Hossain and Latif (2009) in a study to determine the drivers of housing price volatility in Canada established that both positive and negative changes in GDP growth rates make housing prices more volatile.

Secondly, prime lending rates are used to calculate mortgages, credit cards and other consumer loan interest rates. Hence the prime lending rate plays a huge role in the housing market and therefore viewed as one of the most essential macroeconomic factors that influence house prices. Andrews (as cited in Panagiotidis & Printzis 2015) argued that there is a negative relationship between house prices and interest rates. An increase in interest rates, for instance, means a rise in the cost of borrowing and high mortgage repayments. This discourages home buyers, thereby decreasing demand and prices. Akumu (2014) and Zhu (as cited in Pillaiyan, 2015) both found that there is a negative relationship between interest rates and house prices. When considering the volatility aspect, Reen and Razali (2016) found lending rates to be a significant driver of house price volatility, while Hossain and Latif (2009) confirmed that an increase in mortgage rates increase house price volatility.

Houses can be acquired either through cash purchase or mortgage. However, since many individuals are cash constrained, mortgage forms the majority of home purchases. Pillaiyan (2015) stated that the sensitivity of mortgage loans once caused a cyclical movement in property prices which were followed by a bubble burst. Moreover, asset price bubbles have often been preceded by rapid expansion of credit. Mansor et al., (as cited in Pillaiyan, 2015) confirmed that bank loans which include mortgage loans have significant impacts on short-run variations in house prices but have a positive long-run relationship with house prices. Thus, the conclusion from this is that there is a positive relationship between amounts of mortgage loans granted and house price volatility.

To sum up, Tupenaite et al., (2017) in their study established that economic indicators including GDP, interest rates and mortgage loans have significant impacts on housing market fluctuations. Given this background, the relationships listed in table 4.3 are expected between house price volatility and the selected determinants.

Figure 4.3: Drivers of house prices and house price volatility



Source: Author's compilation

Table 4.3: Expected Relationships

Variable	**Expected Sign**
Prime Lending Rate	Positive (+)
Gross Domestic Product	Positive (+)
Mortgage Loans	Positive (+)

Source: Author's compilation

4.4 Data Analysis

An approach similar to that of Hossain and Latif (2009) was adapted to examine the study's objectives. The study employed Autoregressive Conditional Heteroskedasticity (ARCH), Generalized Autoregressive Conditional Heteroscedastic (GARCH) models to determine if the Namibian housing market is volatile and then extracted a volatility series that was used in the Vector Autoregressive (VAR) model as a dependent variable.

4.4.1 Testing for volatility and its level of persistence in the Namibian Housing Market

The ARCH and GARCH models have become the most used tools for measuring or analysing volatility. Dlamini (2014) stated that the ARCH is defined in terms of the distribution of errors of a dynamic linear regression model and is modelled by allowing the conditional variance of the error term to be dependent upon previous lags of the squared residuals as shown below:

$$\delta_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2 \ldots\ldots \quad (1)$$

Where δ_t^2 denotes the conditional variance and μ_{t-1}^2 is the lagged squared residual terms. However, the ARCH model has certain limitations. Brooks (2008) stated that it might be difficult to decide on the number of squared residual lags to include in the model and non-negativity constraints might be violated. Moreover, ARCH specifications appear more like moving average specifications than autoregressions (Engle, as cited in Dlamini, 2014). Hence the GARCH model, an extension of the ARCH that allows the conditional variance to be dependent on both the lagged squared residual terms and its past lags are preferred (Brooks, 2008). It is against this background that this paper further tested for GRACH effects to see the level of volatility persistence. The general GARCH conditional variance equation is expressed as follows:

$$\delta_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2 + \beta \delta_{t-1}^2 \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (2)$$

Where, α_1 nd β denote the ARCH and GARCH terms respectively. The summation of the terms indicates the persistence of volatility shocks. As per the rule of thumb, volatility is persistent when this root is close to unity (Dlamini, 2014).

4.4.2 The Vector Autoregressive (VAR) Analysis

To identify the determinants of house price volatility, the regression analysis was based on the Vector Autoregressive (VAR) model. VAR is a general dynamic specification where each variable is a function of lagged values of all variables in the system (Wilson & Sheefeni, 2014). Additionally, VAR models are used to identify how an endogenous variable responds to its shock and those in all other endogenous variables (Hossain & Latif, 2009). In VAR, each endogenous variable is explained by its past values and by those of all other variables in the system, and there are no exogenous variables (Gujarati, 2003). The study followed this approach because of its several advantages when compared with univariate time series models. Brooks (2008) stated that the VAR technique is easy to estimate, has good forecasting capabilities, allows all variables to enter the model as endogenous and is more flexible as it allows a variable's values to depend on more than just its lags. However, it faces problems of determining appropriate lag lengths and requires all components to be stationary (Gujarati, 2003). Given that, the following VAR model was estimated:

$$(LNY_t = LNVOLTY_t, LNPLR_t, LNGDP_t, LNML_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where Y_t is a vector of all endogenous variables comprising of logged forms of the house price volatility series denoted by (LNVOLTYt), prime lending rate ($LNPLR_t$), Gross Domestic Product ($LNGDP_t$) and mortgage loans ($LNML_t$). The multivariate Vector Autoregressive (VAR) model took the form:

$$\begin{pmatrix} VOLTY_t \\ PLR_t \\ GDP_t \\ ML_t \end{pmatrix} = \begin{pmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \end{pmatrix} + \begin{pmatrix} \emptyset_{11}^1 & \cdots & \emptyset_{14}^1 \\ \vdots & \ddots & \vdots \\ \emptyset_{41}^1 & \cdots & \emptyset_{44}^1 \end{pmatrix} \begin{pmatrix} VOLTY_{t-1} \\ PLR_{t-1} \\ GDP_{t-1} \\ ML_{t-1} \end{pmatrix} + \begin{pmatrix} \emptyset_{11}^2 & \cdots & \emptyset_{14}^2 \\ \vdots & \ddots & \vdots \\ \emptyset_{41}^2 & \cdots & \emptyset_{44}^2 \end{pmatrix} \begin{pmatrix} VOLTY_{t-2} \\ PLR_{t-2} \\ GDP_{t-2} \\ ML_{t-2} \end{pmatrix} + \ldots$$

$$+ \begin{pmatrix} \emptyset_{11}^4 & \cdots & \emptyset_{14}^4 \\ \vdots & \ddots & \vdots \\ \emptyset_{41}^4 & \cdots & \emptyset_{44}^4 \end{pmatrix} \begin{pmatrix} VOLTY_{t-\rho} \\ PLR_{t-\rho} \\ GDP_{t-\rho} \\ ML_{t-\rho} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{pmatrix} \quad \varepsilon_t \sim IN(0, \Sigma) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where the Cs are vectors of constants, ∅s are vectors of coefficients and εts are the error terms or impulses. The steps involved in the VAR regression analysis are outlined in the following subsections.

4.4.2.1 Testing for Stationarity

The first step in VAR models is to investigate the series' unit root characteristics and determine the order of integration through unit root tests. According to Brooks (2008), testing for stationarity is relevant because a variable's stationarity properties can have a strong impact on its behaviour and the regression of a nonstationary series on another may produce nonsensical results.

Moreover, time series data usually has trended time series. Hence, they contain unit root (Sheefeni, 2013). The concept of being stationary implies that the variable has constant mean, variance and autocovariances (Brooks 2008). Hence, it is imperative to investigate its characteristics to avoid problems of misleading results which might imply a significant relationship between variables although such a relationship does not exist. Unit root tests were partially introduced to help researchers in whether to use forecasting models in differences or levels. It was however confirmed by Box and Jenkins (1976) that using models in differences, rather than in levels can yield better forecasts.

Knowing the order of integration is also essential for setting up an econometric model and do inference. Vogelvang (2005) emphasised that to obtain a satisfactory econometric model, it is essential to know the trend behaviour of econometric variables in question. If the variables are stationary in levels, for example, the Ordinary Least Squares (OLS) method can be applied for estimations. Otherwise they must be differenced until they become stationary for other methods to be applied. There exist some unit root tests including the Augmented Dickey-Fuller (ADF), Phillips and Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and modified Dickey-Fuller (DF).

The order of integration means the number of times a series is differenced before it becomes stationary (Wickremasinghe, 2005). Variables are said to be integrated of order zero if they are stationary in levels and of order one if they only become stationary after the first difference. Gujarati (2003) stated that the null hypothesis for unit root tests is that, the variable under consideration contains a unit root and it is tested against the alternative hypothesis that the variable is stationary. In testing for unit root characteristics of the variables, the study employed the ADF and PP tests. This is because most Dickey-Fuller tests have limitations including that of lower power as they tend to accept the null hypothesis more often than necessary, thereby finding that a variable is nonstationary even when it is stationary (Gujarati, 2003). Hence, it is important that a confirmatory test, in this case, the PP test was conducted.

4.4.2.2 Testing for Cointegration

Once the unit root process is examined, the next step is to test for cointegration. If two or more series are found to be non-stationary but their linear combination is, then they are known to be cointegrated. Variables are said to be cointegrated if a long-term relationship exists between them (Gujarati, 2003). This implies that the series move together in the long run, but not at the same rate. Cointegration relationships among variables can be established by applying either the Engle-Granger Test, the Cointegration Regression Durbin-Watson (CRDW) test or the Johansen cointegration test (Sheefeni, 2013). If cointegration is found among the series, the short-run adjustment to the long run equilibrium can be obtained using the Vector Error Correction Model (VECM). Otherwise a VAR Short run analysis is conducted (Sheefeni, 2015). Since this is a multivariate model, the study employed the Johansen cointegration test approach which according to Brooks (2008) is based on two statistics, the Trace and Maximum Eigen. The decision rule is that, if the test statistic is greater than the critical value, reject the null hypothesis and conclude that a long run relationship exists among the variables and the opposite holds when the critical value is greater.

4.4.2.3 Determination of Optimal Lag Length

When running regressions on time series data, it is vital to include lagged values of all variables in the specified model. The determination of a proper lag structure has a significant effect on subsequent inferences, whether they are about causality, cointegration or forecasting (Gonzalo & Pitarakis, 2000). Brooks (2008) however indicated that there is often confusion about the proper lag to use in a VAR and the period which variables take to work through the system. Additionally, caution should be taken when deciding on the number of lags because choosing too few lags may result in misspecification and too many lags could result in the loss of degrees of freedom (Gujarati, 2003). However, there are ways of choosing an optimal lag, including the information criteria. These criteria are Hannan-Quinn (HQ), Schwarz Information Criterion (SC), Akaike Information Criterion (AIC), Final Prediction Error (FPE) and Likelihood Ratio (LR) (Sheefeni, 2015).

There is often confusion regarding which criterion is most appropriate in determining the optimal lag. Theoretically, SC and HQ lead to the most accurate results in both stationary and non-stationary systems, whereas AIC is characterised by a positive limiting probability of overfitting (Gonzalo & Pitarakis, 2000). Brooks (2008) also noted that although SIC is strongly consistent, it is inefficient while the AIC is inconsistent but generally more efficient. However, one cannot say for sure which criterion is the best. Section 5.3.3 explains how the problem of choosing the best criterion was dealt with.

4.4.2.4 Testing for the Stability of the model

After estimating the VAR/VECM model, it is imperative that it is post tested for stability and serial correlation issues among others. The essence of this is to determine the authenticity, reliability and validity of the results that will be generated. For the stability test, the sufficient and necessary condition for a model to be considered stable is that all characteristic roots lie inside the unit circle or the moduli should lie within the range -1 and 1.

4.4.2.5 Testing for Causality

Although a long run relationship is found amongst variables implying that there is causality in at least one direction, it still does not prove the exact direction of influence. Therefore, the essence of a causality test is to determine whether one-time series is good for forecasting the other or vice versa. The Granger representation theorem states that, if two-time series share a long run relationship and they are both integrated of order one, I(1), then either one must Granger cause the other (Gujarati, 2003). The implication of this is that cointegration and the order of integration need to be established first, otherwise testing for causality would be meaningless. Lin (2006), stated that the Granger causality test is based on assumptions that the past predicts the future and not the other way around and that a cause has information about an impact that cannot be found anywhere else.

In analysing the causal relationship between house price volatility and its determinants, the study employed the Granger causality test. Gujarati (2003) stated that since the past comes before the future and if A causes B, then changes in A should happen before changes in B. Hence if including lags of A in a regression of B on other variables plus its lags improves the forecast of B, then it can be concluded that A Granger-causes B and vice versa. There are two ways to state what type of causality relationship exists between variables in the system. On the one hand, if A Granger-causes B and not vice versa, then it can be said that there is unidirectional causality from A to B (Brooks, 2008). On the other hand, if A Granger-causes B and in turn B causes A, then it can be concluded that there is bi-directional causality. Brooks (2008) however cautioned that Granger causality does not mean movements in one variable are responsible for changes in the other. It merely means there is a correlation between the current value of one variable and the past values of others.

4.4.2.6 Impulse Response Function (IRF)

The next step in the VAR system is to check for impulse response function since causality tests alone do not give many details about the interaction between variables. It is therefore essential to know how one variable responds to shocks in all other variables in the system. Impulse responses trace out the response of the dependent variables to one standard deviation shock to other variables in the VAR (Brooks, 2008). Hence, for each variable in each equation separately, a unit shock is applied to the error, and the effects over time are noted.

Furthermore, if variables are nonstationary and share a long-run relationship, then the estimated impulse response function is more consistent and would give best estimates in error correction models than it would in VAR models (Lin, 2006). Hossain and Latif

(2009) stated that although variance decompositions indicate how much of the variability in the dependent variable an independent variable is responsible for, it does not show whether the impact is negative or positive or whether it is transitory or permanent. Impulse responses, on the other hand, show the system's dynamic behaviour. For this reason, the Impulse Response Function Exercise was carried out through the Vector Error Correction Model.

The paper made use of the Generalized Impulse Response Function (GIRF) instead of the Cholesky decomposition. This is because Cholesky has an issue of ordering variables from top to bottom but not the other way around. To avoid this, Lin (2006), urged that the GIRF is more reliable since it is not affected by the problem of ordering variables.

4.4.2.7 Forecast Error Variance Decomposition

Hossain and Latif (2009) stated that Granger causality tests do not expose much information on how much a change in a variable contributes to fluctuations in another variable. However, the variance decomposition (VDC) analysis shows precisely how a shock to one variable influences change in another variable. It separates the total variance in the dependent variable for each future period and indicates how much of this change each independent variable is responsible for. Hence, analysing variance decompositions, which is an alternative method to the impulse response functions for examining the effects of shocks to the dependent variable is the final step in VAR.

Variance decompositions provide information on how much of the forecast variance for any variable in a model is explained by innovations to each independent variable over a period (Brooks 2008). It can be noted that own shocks usually explain most of the forecast error variance in the variable but would also be transmitted to all other variables in the system through the dynamic structure.

4.5 Research Ethics

Ethics refer to doing what is morally and legally right while conducting research (Dantzker & Hunter, 2012). Therefore, researchers are required to consider ethical issues when collecting and analysing data. For this reason, this study acknowledges all sources of information and data using the American Psychological Association (APA) referencing style. Only sources cited in-text appear in the reference list. For analysis, results are reported as obtained from the regression analysis and no modification took place. Conclusions and recommendations are also only based on the study's findings.

4.6 Conclusion

This chapter discussed the research design, the conceptual framework, the models used for estimations and research ethics. It was indicated that due to its nature, the study followed an experimental research design and a quantitative approach. Expected relationships between the dependent and independent variables were also listed in this chapter. It was further specified that ARCH and GARCH models were used to determine if house prices in Namibia are volatile and how persistent the volatility is. All steps followed in VAR to establish the drivers of house price volatility and causal links, from unit root testing to variance decompositions were outlined. The findings from the regressions are discussed in the next chapter.

CHAPTER FIVE: ANALYSIS AND DISCUSSIONS OF EMPIRICAL FINDINGS

5.1 Introduction

Chapter five discusses the empirical results of the study which are analysed in the following sequence: section 5.2 discusses findings from the ARCH and GARCH models while section 5.3 looks at the findings of the VAR analysis. Section 5.3 is divided into subsection to discuss the findings of unit root tests, Johansen cointegration, optimal lag length, VECM model, diagnostic tests, Granger causality test, impulse response functions and the variance decompositions.

5.2 Testing for the presence of price volatility and its persistence in the Namibian housing market

Tables 5.2.1 to 5.2.3 present the results of the ARCH (1, 0), GARCH (0, 1) GARCH (1, 1) models. These models were all applied for confirmation and to see which method yields the best results regarding house price volatility and its persistence. From table 5.2.1, the residual term is significant with a p-value of 0.004 suggesting that the null hypothesis of no ARCH effect can be rejected at the 5 percent level of significance. The presence of heteroskedasticity in the model means that house prices are volatile in Namibia. It was alluded to earlier that the GARCH model performs better than the ARCH. Hence, the GARCH (0, 1) which excludes an ARCH term and the GARCH (1, 1) were modelled. The number of lags in the GARCH model makes no empirical difference, as GARCH (0, 1) and GARCH (1, 1) generate an almost identical estimation of volatility. From table 5.2.2, the GARCH term is significant at the 5 percent level, confirming that house prices are indeed volatile in Namibia. These results confirm the findings of Miller and Peng (2004);

Hossain and Latif (2009), Tu and Zhou (2015) who tested for the presence of volatility in housing markets through similar approaches. Table 5.2.3 shows the GARCH (1, 1) results and shows that the summation of alpha (ARCH term) and beta (GARH term) is 0.997 and are both significant at the five percent level of significance. According to Dlamini (2014), the rule of thumb is that this summation should be close to one in order to conclude that volatility is persistent. Hence, the value of 0.997 is close to unity, suggesting that house price volatility is highly persistent or has long-lasting effects in Namibia. Given that the presence of volatility was found, the study further employed the VAR/VECM models to identify the determinants of this volatility.

Table 5.2.1: ARCH (1, 0)

Variable	**Coefficient**	**P-Value**
Constant	6.459	0.000**
RESID^2(-1)	-0.139	0.004**

Source: Author's compilation and values obtained from Eviews
*Note: ** denote 5% level of significance and resid^2(-1) is the ARCH term*

Table 5.2.2: GARCH (0, 1)

Variable	**Coefficient**	**P-Value**
Constant	0.586	0.437**
GARCH(-1)	0.917	0.000**

Source: Author's compilation and values obtained from Eviews
*Note: ** denote 5% level of significance and GARCH (-1) is the GARCH term*

Table 5.2.3: GARCH (1, 1)

Variable	Coefficient	P-Value
Constant	0.227	0.675
RESID(-1)^2	-0.214	0.012**
GARCH(-1)	1.211	0.000**

Source: Author's compilation and values obtained from Eviews
Note: resid^2(-1) and GARCH (-1) denote the ARCH and GARCH terms respectively

5.3 VAR Analysis of the Determinants of House Price Volatility in Namibia

5.3.1 Unit Root Tests Results

It was mentioned that the importance of testing for unit root revolves around examining the stationarity of time series data. To identify the order of integration of all the variables, this study employed the Augmented Dickey-Fuller (ADF) and Phillips-Perrons (PP) tests. Two different tests were used in order to ensure the robustness of the results. The unit root tests' results are presented in table 5.3.1. Table 5.3.1 shows that all variables contain a unit root in levels, thus accepting the null hypothesis of non-stationarity. This is however in exception of GDP which shows conflicting results with both ADF and PP statistics showing significance at five percent when regressed with a trend and intercept. It is noteworthy that in order to use the VAR/VECM models, all variables are required to be stationary. Hence, all variables were differenced once, and all became stationary at the five percent level of significance, although the ADF statistic for prime lending rate with intercept showed contradicting results that it is not stationary. That is to say that shocks to the variables are not permanent and the effect would disappear and revert to its long run.

It can, therefore, be concluded that all variables used in the model are integrated of order one and are fit to be estimated through the VECM.

Table 5.3.1: Unit root tests: ADF and PP in levels and first differences

Variable	**Model Specification**	**ADF**	**PP**	**ADF**	**PP**	**Order of Integration**
		Levels	**Levels**	**First Difference**	**First Difference**	
$Lnvolty_t$	Intercept	-1.210	-1.448	-3.419**	-3.409**	I (1)
	Trend and Intercept	-1.737	-1.627	-3.762**	-3.632**	I (1)
$Lnplr_t$	Intercept	-1.362	-1.412	-1.511	-4.371**	I (1)
	Trend and Intercept	-0.458	-0.672	-4.663**	-4.510**	I (1)
$Lngdp_t$	Intercept	-0.464	-4.451	-6.446**	-15.825**	I (1)
	Trend and Intercept	-4.366**	-4.373**	-6.352**	-18.673**	I (1)
$Lnml_t$	Intercept	-0.193	-0.194	-6.137**	-6.136**	I (1)
	Trend and Intercept	-1.748	-1.779	-6.056**	-6.055**	I (1)

Source: Author's compilation and values obtained from Eviews
*Notes: ** denote stationarity at 5% significance level.*

5.3.2 Cointegration Test

Since all variables were nonstationary in levels and are all integrated of the same order, I(1), the Johansen cointegration test based on Trace and Maximum Eigenvalues test statistics were conducted to test for a long run relationship. From the results presented in table 5.3.2, the Trace test indicates three cointegrating equations, while the Maximum

Eigen test indicates one cointegrating equation for the endogenous series during the sample period at the five percent significance level. This is because the statistics are greater than the critical values, therefore rejecting the null hypothesis of no cointegrating variables. It is worth noting that the Trace test gives more reliable results than the Maximum Eigen test. Hence, conclusions are based on the Trace test, i.e. there are three cointegrating equations.

In the context of the study, the presence of cointegration implies that house price volatility, interest rates, gross domestic product and mortgage loans share a long-term relationship. It means that changes in either variable have a long-lasting effect on other variables. Therefore, the study further conducted long run analysis through the VECM.

Table 5.3.2: Johansen Cointegration Test Results

Trace Test				**Maximum Eigen Test**			
H_0: rank=r	H_a: rank=r	Statistic	95% critical value	H_0: rank=r	H_a: rank=r	Statistic	95% critical value
r=0	r=1	58.934	40.175**	r=0	r>=1	29.561	24.159**
r<=1	r=2	29.372	24.276**	r<=1	r>=2	14.413	17.797
r<=2	r=3	14.959	12.321**	r<=2	r>=3	13.476	11.225
r<=3	r=4	1.483	4.129	r<=3	r<=4	1.483	4.129

Source: Author's compilation and values obtained from Eviews

Notes: Trace test indicate three cointegrating equations, while Max-Eigen test indicates one cointegrating equation at the 0.05 level (**). The reported results are for the tests with no deterministic trend and intercept.

5.3.3 Determination of the Optimal Lag Length

According to Sunde and Muzindutsi (2017), estimations of lag orders (p) in a VAR (p) model are built on lag order selection statistics. For this study, the optimum lag length was selected based on various information criteria. Particularly, the lag length criteria was set based on the Log Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn criterion (HQ). As aforementioned, there is usually confusion regarding which criteria gives most accurate results. However, there is an opinion that the Hannan-Quinn and Schwarz criterion perform best.

Table 5.3.3 show the test statistics for the above-mentioned criteria, for all the full VARs of an order less than or equal to three. The LR, FPE, SIC and HQ statistics suggest a lag length of one while the AIC test suggest a lag length of three. However, since the majority tests select a lag of one at the 5 percent significance level including the Hannan-Quinn and Schwarz which are hypothesized to work better, the study uses a lag of one or a VAR (1) model.

Table 5.3.3: Lag Order Selection

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	50.217	NA	9.66e-07	-2.498	-2.324	-2.437
1	244.965	336.862*	6.19e-11*	-12.160	-11.289*	-11.853*
2	259.675	22.264	6.86e-11	-12.091	-10.523	-11.538
3	278.323	24.192	6.48e-11	-12.234*	-9.969	-11.436
***** indicates lag order selected by the criterion						
LR: Sequential Modified LR Test Statistic (each test at 5% level)						
FPE: Final Prediction Error						
AIC: Akaike Information Criterion						
SC: Schwarz Information Criterion						
HQ: Hanan-Quinn Information Criterion						

Source: Author's compilation and values obtained from Eviews

5.3.4 The Determinants of House Price Volatility in Namibia

Since cointegration was found among the variables, the Vector Error Correction Model (VECM) was estimated. Equation 5 below shows the general VECM model (taken from Eviews) that was estimated to obtain the results presented in table 5.3.4. In the equation, C (1) and C (2) represent the Error Correction Terms (ECT) for each cointegrating equation and give information about the speed of adjustment of volatility to its long-run equilibrium, whereas C (3) to C(10) represent the short run coefficients.

$$
\begin{aligned}
D(LNVOLTY) = C(1) \\
&* \Big(LNVOLTY(-1) - 3.41597451719 * LNGDP(-1) \\
&+ 3.59948790473 * LNML(-1) + C(2) \\
&* \Big(LNPLR(-1) - 0.726146587476 * LNGDP(-1) + 0.42130039003 \\
&* LNML(-1) + C(3) * D\big(LNVOLTY(-1)\big) + C(4) \\
&* D\big(LNVOLTY(-2)\big) + C(5) * D\big(LNPLR(-1)\big) + C(6) \\
&* D\big(LNPLR(-2)\big) + C(7) * D\big(LNGDP(-1)\big) + C(8) \\
&* D\big(LNGDP(-2)\big) + C(9) * DLNML(-1)\Big) + C(10) \\
&* D\big(LNML(-2)\big)\ \Big) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (5)
\end{aligned}
$$

The estimated parameters of the modelling technique are presented in Table 5.3.4. Interpretations focused on variables that statistically significant affect house price volatility. They particularly, Focus on the dynamic response of house price volatility to exogenous changes in volatility itself, GDP and mortgage loans. The first important finding is that a one percent increase in past volatility would significantly increase current volatility by 0.67 percent. This implies that if house prices are volatile this quarter, people should expect it to even be more volatile in the next quarter. This finding confirms the result of Miller and Peng (2004) and Savva and Michail (2017). The second important, but the surprising finding is that a one percent increase in GDP results into a 5.45 percent decrease in the house price volatility. This contradicts the economic theory that there is a positive relationship between the variables but concur with findings by Reen and Razali (2016) and Tupenaite et al. (2017) that GDP is one of the most significant macroeconomic determinants of house price dynamics. The findings suggest that an increase in GDP is good for the Namibian economy as it reduces volatility in the housing market, which is known to cause uncertainties. Savva and Michail (2017) explained that credit expansion attracts investors to the housing market thereby increasing speculations, hence lead to an increase in house price volatility. This can be confirmed by the third significant finding that, if mortgage loans for the past two quarters increased by one percent, volatility would increase by 15.09 percent. This finding is in line with Mansor et al., as cited in Pillaiyan (2015) that there is a positive and long-run relationship between the series and that of Tupenaite et al., (2017) who found housing mortgages significant.

Furthermore, mortgage loans may include closing costs such as mortgage insurance and taxes which may make the loan more expensive. Hence the finding is also in line with the user cost theory that an increase in user costs such as property taxes may push house prices up. The implication is that increased mortgage loans are undesirable because they increase volatility which was said to cause problems at a macroeconomic level.

Moreover, banks give loans to finance housing as it alluded to earlier in chapter two. When people are given more mortgage loans, they can afford houses which in turn lead to an upward trend in house prices as suggested by the findings. The findings are also in line with Sunde and Muzindutsi (2017), who discovered a positive link between house prices and mortgage loans.

The impact of an increase in the prime lending rate is insignificant although the coefficient shows a positive relationship when lagged twice. This positive relationship, although insignificant is in line with the user cost theory that a positive change in interest rates brings about, a positive change in house prices. These findings are in line with Kim et al. (2016) and Lee (2009) who found that lending rates are not a significant determinant of house prices and house price volatility, but inconsistent with Reen and Razali (2016) and Tupenaite et al. (2017) who found the variable to be a significant determinant.

Additionally, the coefficient of the error correction term for the first cointegrating equation indicates that it takes about 0.31 percent for house price volatility to adjust to its long-run equilibrium and it is significant at the 5 percent level. The coefficient for the second cointegration equation error term is insignificant. Moreover, the adjusted coefficient of determination value of 0.42 percent means that the independent variables account for 0.42 percent of the variations in house price volatility. Both the Durbin Watson (DW) statistic and Lagrange Multiplier (LM) test fail to reject the null hypothesis of no serial correlation. In the same vein, the ARCH probability value indicates the absence of heteroskedasticity among the variables while the cumulative sum (CUSUM) test suggests that the estimated model is stable at the 5 percent level of significance. Briefly, the performance of these diagnostic tests implies that the obtained findings are reliable which confirms the rigour of the analysis conducted.

Table 5.3.4 VECM Model Results

Dependent Variable: LNVOLTY		
Variable	Coefficient	P-Value
ECT_{1t-1}	-0.309	0.003**
ECT_{2t-1}	-0.564	0.444
$\Delta LNVOLTY_{t-1}$	0.672	0.003**
$\Delta LNVOLTY_{t-2}$	-0.302	0.874
$\Delta LNPLR_{t-1}$	-1.649	0.406
$\Delta LNPLR_{t-2}$	1.233	0.550
$\Delta LNGDP_{t-1}$	1.349	0.443
$\Delta LNGDP_{t-2}$	-5.448	0.005**
$\Delta LNML_{t-1}$	10.715	0.168
$\Delta LNML_{t-2}$	15.087	0.037**
Adjusted R-Square	0.422	
Diagnostic Tests		
Durbin-Watson (DW)	1.625	
LM-test	11.729 (0.762)	
ARCH	-0.112 (0.661)	
CUSUM Test	Stable**	

Source: Author's work and values obtained from Eviews
*Note: ** indicate 5% significance level. The figures in brackets on the diagnostic tests are the probability values. The reported results are for the tests with no intercept or trend.*

5.3.5 Post Estimation Diagnostic

It is necessary to analyse the post-estimation diagnostic of the whole VECM model to determine whether its results can be trusted or if the model is stable so that it can be corrected if it is unstable to avoid misleading results. To achieve this, the study uses the Lagrange Multiplier (LM) test for autocorrelation and the VECM stability test. If these tests give good results, then it can be concluded that the results of the model can be considered valid and authentic. The results of these diagnostic tests are presented below. To begin with, table 5.3.5.1 summarises the results for autocorrelation disturbance terms for the whole model. The Lagrange Multiplier test fails to reject the null hypothesis of no autocorrelation of residuals at the five percent level of significance since all the probability values are greater than 0.05. Secondly, the entire model's estimated stability test results are presented in table 5.3.5.2. As per the rule of thumb, a model satisfies the stability condition if the Eigen-values or the roots lie within the range -1 and 1. The VECM specification used imposes three-unit roots, and the rest of the roots in the model have moduli that are less than one. The latter results imply that the model estimated is stable and the variables are fit for further regressions.

Table 5.3.5.1 Lagrange Multiplier test for autocorrelation

Lags	LM-Stat	Probability
1	11.729	0.762
2	5.741	0.991

Source: Author's Compilation

Table 5.3.5.2 Roots of Characteristic Polynomial

Root	Modulus
1.000000	1.000000
1.000000	1.000000
1.000000	1.000000
-0.075900 - 0.828607i	0.832076
-0.075900 + 0.828607i	0.832076
0.733770 - 0.084537i	0.738624
0.733770 + 0.084537i	0.738624
-0.664107	0.664107
0.184732 - 0.459150i	0.494919
0.184732 + 0.459150i	0.494919
-0.292900	0.292900
0.275713	0.275713

Source: Author's compilation
Notes: the VECM specification imposes 3 unit roots

5.3.6 Granger Causality Test

In this section, the VEC Granger Causality/Block Exogeneity Wald test was employed to determine the causal relationship between house price volatility and its determinants as per the objectives. Table 5.3.6 reports the results. According to the results, there exist significant evidence of unidirectional causality from GDP and mortgage loans to housing price volatility. As noted earlier, Granger causality does not imply that movements in one variable are responsible for movements in another, but that lagged values of the independent variable may help in the prediction of future values of the dependent variable. Hence these results imply that movements in GDP and mortgage loans rates significantly help predict the variations in house price volatility. In other words, it means there is a relationship between past values of GDP and mortgage rates and current values of house prices, i.e. changes in the former variables should take place before changes in the later. The causation of GDP on volatility can be confirmed by Hossain and Latif (2009). Moreover, the findings are different from the findings of Tu and Zhou (2015) who find causality between interest rates and house price volatility, but in line with Hossain and Latif (2009) who found no causality between lending rates and house price fluctuations. It can then be concluded that current changes in GDP and mortgage loans can indicate what is likely to happen in the housing market in the future.

Table 5.3.6: VEC Granger Causality/Block Exogeneity Wald test

	Dependent variables			
Regressors	LNVOLTYt	LNPLRt	LNGDPt	LNMLt
LNVOLTYt	0.00	0.989	0.290	0.429
LNPLRt	0.439	0.00	0.249	0.263
LNGDPt	0.001**	0.017**	0.00	0.019**
LNMLt	0.089*	0.159	0.000**	0.00

Source: Author's compilation and values obtained from Eviews
*Note: ** and * indicate significance at the 5% and 10% levels respectively.*

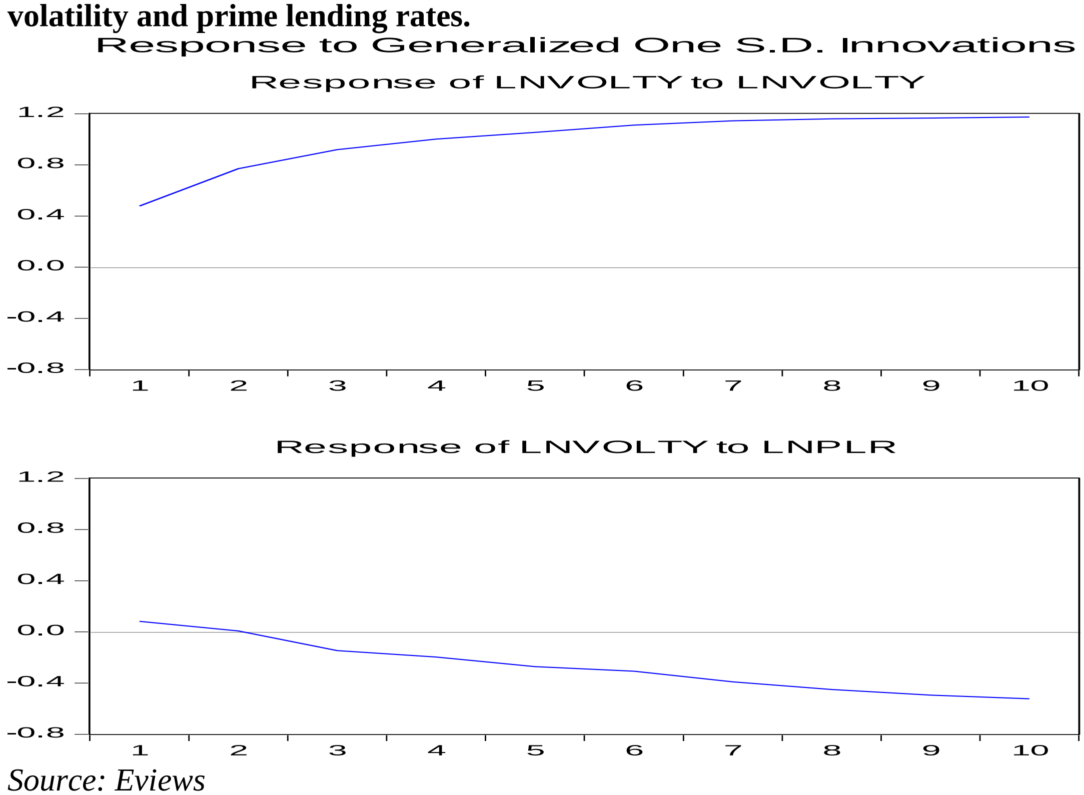
5.3.7 The Impulse Response Functions Analysis

An impulse response function shows how a variable in the VAR system responds to a one standard deviation innovation in other variables of interest (Hossain & Latif, 2009). Since the impulse responses are sensitive to the ordering of the variables, the generalised form was used. Figures 5.3.7.1 to 5.3.7.3 demonstrate the impulse response functions showing the dynamic behaviour of housing price volatility due to random shocks in the volatility itself, prime lending rate, GDP and mortgage loans.

Figure 5.3.7.1 shows how house price volatility responds to an exogenous increase in itself and to an increase in prime lending rates. The upper graph in the figure shows that an exogenous increase in the volatility magnifies the volatility level in subsequent quarters and the impact seems to be permanent as it does not die out. This suggests that if citizens experience house price volatility in the current period, they should also expect it in the next period. This finding confirms that of Miller and Peng (2004). The next observation is that an exogenous increase in the prime lending rate mitigates volatility. As figure 5.3.7.1 shows, the volatility begins to decrease immediately after the shock, and the impact seems to be permanent as volatility kept on decreasing over the cycle without returning to its normal level. This implies that an increase in prime lending rate is desirable for the Namibian citizens because it makes house prices less volatile and it was alluded to in chapter one that volatility in the housing market is problematic. Theoretically, there is a positive relationship between the variables. Hence, these results are contradicting. The results are also inconsistent with the findings of Hossain and Latif (2009) that a positive shock to interest rates increases house price volatility.

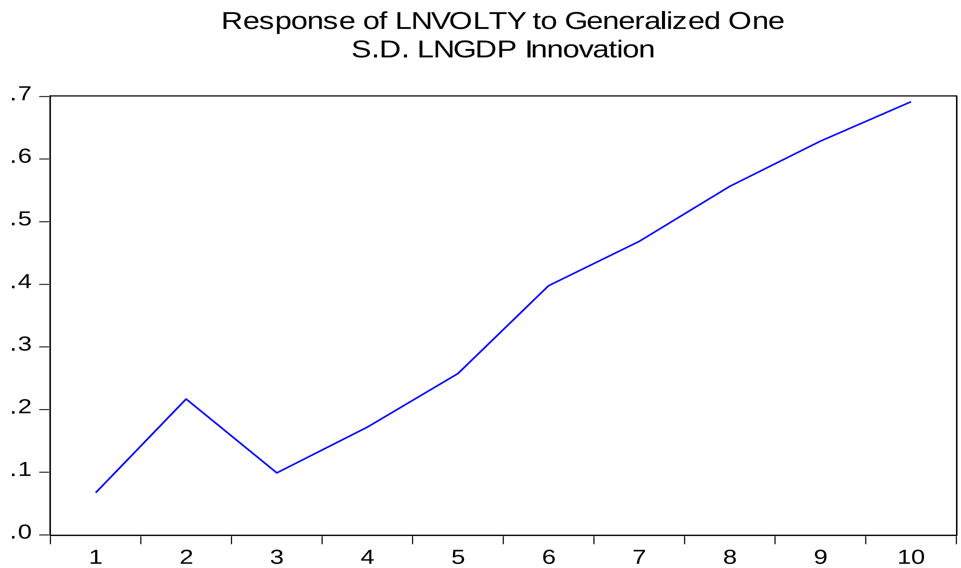
Figure 5.3.7.2 reveals how house price volatility responds to a transitory increase in the gross domestic product. The volatility peaks at about two percent higher than the equilibrium level two quarters after the positive shock. However, starts decreasing until the third quarter, then increases again for the rest of the quarters. This suggests that an increase in GDP can mitigate volatility in the short run but magnifies it in the long run, and the effect is permanent. These results are quite consistent with the findings of Hossain and Latif (2009) who discovered that positive shocks to the GDP growth rate magnify house price volatility but contradicting at the same time. Hossain and Latif (2009) found that although a positive shock to GDP magnifies volatility the effect is temporary. The implication of this is that since a rise in total output is desirable since it increases GDP per capita, it is still undesirable because it creates another problem of making house prices more volatile.

Figure 5.3.7.1 Response of house price volatility to a standard deviation shock in volatility and prime lending rates.



Source: Eviews

Figure 5.3.7.2 Response of house price volatility to a standard deviation shock in Gross Domestic Product

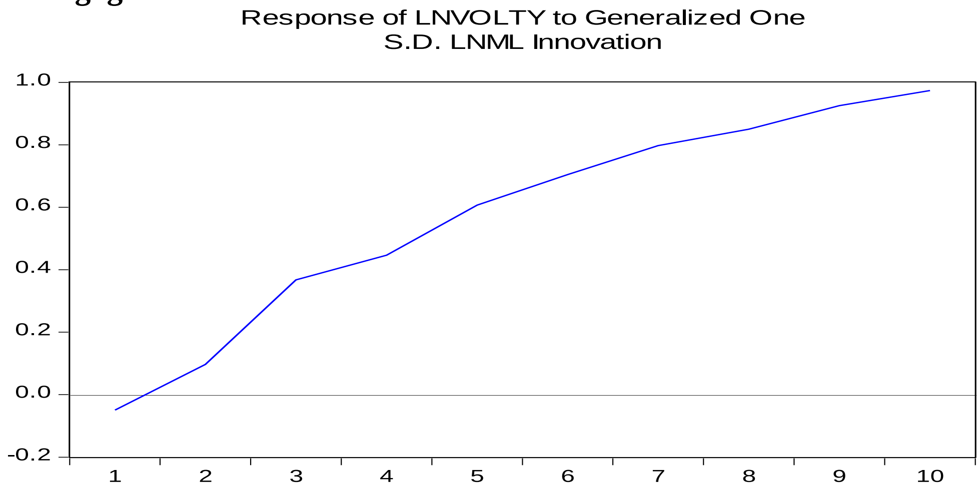


Source: Eviews

Figure 5.3.7.3 demonstrates the impact of a positive shock emanating from mortgage loans on house price volatility. The figure shows that a transitory increase in mortgage loans leads to a rise in housing price volatility. The effect appears to be permanent as it does not die out after the shock. These results concur with those of Mansor et al. as cited in Pillaiyan (2015) who discovered that bank loans which include mortgage loans have significant impacts on house prices movements. It is also in line with the economic theory and the findings of Sunde and Muzindutsi (2017) that there is a positive link between house prices and mortgage loans.

In a nutshell, the impulse response function results confirm the cointegration test results that a movement in either variable will have long-lasting effects on the others. It should be noted that, since volatility involves both upward and downward swings, the study assumes that a rise in house price volatility signifies a rise in house prices and vice versa.

Figure 5.3.7.3: Response of house price volatility to a standard deviation shock in mortgage loans



Source: Eviews

5.3.8 Variance Decomposition (VDC) Analysis

As aforementioned, a Granger causality test alone does not reveal much information concerning the explanatory power of a variable to the variation in another, but the variance decomposition does. The variance decomposition analysis can specifically show how much of the forecast error variance of house price volatility can be explained by exogenous shocks to other variables. It decomposes the total variance of the volatility in each of the future periods and determines how much of this variation each macroeconomic variable can explain. The VDC results are presented in table 5.3.8 for nine quarters. In this case, the variance decomposition indicates exactly how much of the variations in house price volatility that prime lending rate, GDP and mortgage loans explain. The results demonstrate that the disturbance originating from the mortgage loans explains 16.22 percent of the variation in house price volatility after six quarters. Even after nine quarters, it still explains 18.65 percent of the variation. The results further show that, of the total variation in housing price volatility, the current volatility accounts for 70.76 percent after six quarters and 60.82 percent after nine quarters. Thus, mortgage loans and current volatility appear to be the most important variables that cause changes in house price volatility in Namibia. The same discovery was made in the VECM estimations, and it confirms the findings of Hossain and Latif (2009) who discovered that current volatility is one of the most significant determinants of house price volatility. These two variables account for 93 percent of the variation in house price volatility after three quarters. The other two variables, prime lending rate and GDP, do not account much for changes in volatility. For example, prime lending rates only contribute 5.66 percent, while GDP contributed 1.05 percent to the variations after three quarters. These results are quite consistent with Hossain and Latif (2009) who found that interest rates and GDP do not explain much of the variations in house price volatility. In their case mortgage rates explained a mere 2 percent and 3.5 percent of the variations in the dependent variable. It can, however, be observed that contributions from current volatility gradually decrease after the third quarter as the other variables' contributions increase. When analyzing the variance decompositions for the rest of the variables in the system, although it decreases with time, most of the variations in the variables are explained by own shocks with the rest of the variables in the system making minimal contributions. In a nutshell, it can be confirmed that macroeconomic variables do play a role in house price volatility analysis. Overall, the Variance Decomposition results are significant in the sense that they specify which of the variables is mostly responsible for changes in volatility. They also imply that movements in current volatility and mortgage loans levels are worth looking out for as they can help predict the future of housing markets. Moreover, rapid fluctuations in these variables are worrisome as they make house prices more volatile.

Table 5.3.8 Variance Decomposition Results

VARIANCE DECOMPOSITION OF LNVOLTYt				
Period	LNVOLTYt	LNPLRt	LNGDPt	LNMLt
1	100	0	0	0
3	84.286	5.665	1.052	8.997
6	70.769	10.134	2.874	16.222
9	60.816	13.502	7.366	18.653
VARIANCE DECOMPOSITION OF LNPLRt				
PERIOD	LNPLRt	LNVOLTYt	LNGDPt	LNMLt
1	96.878	3.122	0	0
3	67.376	1.127	28.889	2.607
6	29.788	0.368	67.664	2.180
9	17.821	0.280	80.139	1.683
VARIANCE DECOMPOSITION OF LNGDPt				
PERIOD	LNGDPt	LNVOLTYt	LNPLRt	LNMLt
1	93.569	1.958	4.472	0
3	72.991	9.519	6.249	11.242
6	68.409	10.270	7.542	13.778
9	67.566	11.015	8.502	13.241
VARIANCE DECOMPOSITION OF LNMLt				
PERIOD	LNMLt	LNVOLTYt	LNPLRt	LNGDPt
1	85.835	1.083	6.486	6.595
3	66.124	2.619	10.539	20.717
6	48.178	2.693	15.651	33.477
9	40.307	2.479	18.124	39.090

Source: Author's compilation and values obtained from Eviews

5.4 Conclusion

This chapter discussed both the ARCH/GARCH and VAR/VECM models empirical findings of the study. Firstly, the ARCH and GARCH models established that the Namibian housing market is volatile and that it is persistent. From the VAR analysis, the unit root test results showed that all variables contained a unit root and were integrated of order one. Moreover, the Johansen cointegration test revealed that there is a long run relationship between house prices and its determinants. Hence, further analysis was conducted through the VECM approach. An optimum lag of one was chosen based on the LR, FPE, SC and HQ criteria. Estimations of the VECM model revealed that volatility itself, GDP and mortgage loans significantly determine house price volatility. Furthermore, a unidirectional causality was found from GDP and mortgage loans to house price volatility. Finally, the IRF and VDC analysis showed that all selected macroeconomic variables, but interest rates have a long-lasting positive impact on house price volatility and that mortgage loans and currency volatility are the most important variables that explain the variation in house price volatility.

CHAPTER SIX: CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1 Introduction

The previous chapter discussed the study's findings. This chapter, therefore, gives a summary of the whole study and recommendations. The chapter is divided into three sections. Firstly, section 6.2 concludes the study, while section 6.3 presents policy recommendations based on the empirical findings and section 6.4 discusses areas for further research.

6.2 Conclusions

This study analysed macroeconomic determinants of house price volatility and attempted to establish the direction of causality between volatility and its determinants using quarterly data for the period 2007 quarter 1 to 2017 quarter two at the national level for Namibia. It was mentioned that the housing market plays an important role in the economy because of its links to other sectors. Due to its high demand, house prices are hypothesised to be more volatile than any other financial asset. However, house price fluctuations may have implications for an economy as it threatens financial stability and has significant negative effects at a macroeconomic level. It was also noted that house prices in Namibia are highly volatile, and the high housing prices experienced over the years in the country might lead to a price bubble in the future.

From the reviewed literature, empirical studies seemed to agree that house prices are indeed volatile and macroeconomic determinants do play a significant role. Most studies agreed on the macroeconomic determinants, while some findings were conflicting depending on the methodologies used and countries studied.

Furthermore, the ARCH and GARCH models were employed to determine whether house prices in Namibia are volatile and the level of persistence. The house price volatility series was estimated through the GARCH model. The Vector Autoregressive (VAR) model was used to study the dynamic interactions between the volatility and macroeconomic fundamentals namely the prime lending rate, GDP and mortgage loans.

The ARCH and GARCH analysis revealed that the Namibian housing market is volatile and it is highly persistent. From the unit root analysis, all variables were found stationary after the first difference through the ADF and PP unit root tests and concluded that they are all integrated of order one. The Johansen cointegration test based on the Trace and Maximum Eigen test statistics found that there is a long run relationship between the variable. Hence, suggesting that further analysis could be modelled through the VECM. A VAR (1) model estimated as suggested as suggested by various optimal lag length criteria. Added to that, the LM test indicated that variables are not serially correlated, whereas the VEC stability test declared the model stable.

Important results were observed from the VECM estimations. Firstly, it was found that volatility itself, mortgage loans and GDP were the most significant determinants of volatility. Surprisingly, GDP was found to have a negative impact, therefore contradicting findings of other researchers. As reviewed in the empirical literature, the prime lending rate was proven to play a minimum role in house price determination.

The Granger causality analysis seemed to confirm the findings of the VECM estimations that only mortgage loans and GDP help predict movement is in-house price volatility. Particularly, a unidirectional causality was found from GDP and mortgage loans to house price volatility. Finally, the IRF and variance decomposition analysis was conducted. The impulse response analysis showed that an exogenous increase in current volatility, GDP and mortgage loans magnify volatility in subsequent periods, and the effects were permanent as they do not die out. A standard deviation shock to the prime lending rate, however, mitigates house price volatility. It was concluded from the VDC analysis that mortgage loans and current volatility were the most important variables that cause changes in house price volatility in Namibia, while GDP and PLR contributions were minimal.

The current study contributes to the existing literature in a way that it provides insight for a smaller economy since the economies reviewed in the literature are mostly developed. Its findings support the literature that macroeconomic variables play a significant role in the housing market.

6.3 Policy Recommendations

The findings of the study have important policy implications which policymakers should pay special attention to and take action on. Firstly, housing is a susceptible issue in Namibia, especially to the households. Many citizens are desperately in need of permanent accommodation, but the majority are left out of the market. Hence, policy-makers should try by all means to consider the importance of including macroeconomic factors in the formulation of national housing policies. Macroprudential regulation is necessary as it may help identify and reduce the risk and the macroeconomic costs that may arise financial instability caused by house price volatility. There should also be proper coordination between the government that is responsible for fiscal policy and Bank of Namibia that is responsible for the monetary policy so that they can have a common goal and ensure that there is no policy conflict. Policy-makers and regulators need to keep track of changes in the macroeconomic factors and understand their impacts on the housing sector to come up with better policies.

Since house price volatility is known to cause negative implications at a macroeconomic level, it is essential for the macroeconomic fundamentals that are linked to volatility to be closely monitored. For example, a rise in credit expansion implies high price volatility which is undesirable for citizens. The close relationship between mortgage and housing markets, therefore, has an important policy implication. The central bank should monitor the growth in mortgage loans closely to ensure that its impact on house price volatility is minimal. If left unchecked, the growth in home loans could lead to financial instability in Namibia. The Bank of Namibia introduced macroprudential regulation in the form of loan-to-value ratios which came into effect on the 22nd of March 2017. This tool with the aim of mitigating high exposure to mortgage loans should be monitored closely to ensure it yields the intended goal.

Lastly, the finding that an increase in real GDP has a negative impact on house price fluctuations suggest that the government should find more ways of improving or maintaining economic growth in order to mitigate house price volatility in Namibia.

6.4 Areas of Further Research

To the researcher's knowledge, this study is the first to analyse the macroeconomic determinants of house price volatility in Namibia which is extremely important given the significance of the housing sector in the economy. The study employed the GARCH and VAR/VECM techniques for analysis. The empirical findings are novel and provide valuable insight into the dynamics of the Namibian housing market. However, it is obvious that the paper experienced challenges. For example, the sample size, the methodology and variables used. It is worth noting that the finding of GDP having a negative impact on house price volatility is something that scholars should be wary of. From the reviewed literature, an increase in GDP is expected to magnify house price volatility instead of mitigating it. This is contradicting the literature. Hence, it is necessary for scholars to research further and find out why and when this may be the case for some economies. It would also be important if scholars can use the same variable (GDP) that was used in this study to see if this finding can be confirmed or not. Admittedly, other factors influence housing market dynamics. Henceforth, further research on this topic is highly recommended. Future researchers can include more variables such as income growth rate, unemployment rate, population growth rate and demographic changes.

REFERENCES

Akumu, D. O. (2014). *The relationship between selected macroeconomic variables and residential housing property returns in Kenya* (Master's thesis, University of Nairobi, Nairobi, Kenya). Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/74859/Akumu_The%20relationship%20between%20selected%20macro%20economic%20variables%20a.pdf?sequence=4&isAllowed=y

Anundsen, A. K., & Nymoen, P. R. (2013). *Housing markets and financial stability* (Doctoral thesis, University of Oslo, Norway). Retrieved from http://www.norges-bank.no/contentassets/2a8120181b8b48909d68cfdc7c8b8302/avhandling_anundsen.pdf

Bank of Namibia. (July, 2015). *Economic Outlook.* Retrieved from https://www.bon.com.na/CMSTemplates/Bon/Files/bon.com.na/04/04922910-1b4c-4fe4-bb3b-88595db1f214.pdf

Bank of Namibia and NAMFISA. (2016). *Namibia Financial Stability Report*. Retrieved from https://www.bon.com.na/CMSTemplates/Bon/Files/bon.com.na/65/65fe081d-3c5d-492d-a0f6-0bc6cba99d89.pdf

Bank of Namibia and NAMFISA. (2017). *Namibia Financial Stability Report*. Retrieved from https://www.bon.com.na/CMSTemplates/Bon/Files/bon.com.na/bd/bd81ca79-7742-4fbe-9e40-22915c75ad61.pdf

Berg, L., & Berger, T (2005). The Q theory and the Swedish housing market- An empirical test. Working Paper 2005/19, Uppsala University, Sweden. Retrieved from https://www.diva-portal.org/smash/get/diva2:102268/FULLTEXT01.pdf

Borowiecki, K. J. (2009). The determinants of house prices and construction: An empirical investigation of the Swiss housing economy. *International Real Estate Review, 12*(3), 193-220.

Box, G.E.P. & Jenkins, G.W. (1976). *Time Series Analysis, Forecasting and Control* (2nd ed.). Holden-Day, San Francisco.

Brooks, C. (2008). *Introductory Econometrics for Finance* (2nd ed.). Cambridge University Press, New York.

Case, K. E., & Shiller, R. J. (2004). Is there a bubble in the housing market? *Coules Foundation Paper No.1089*. Retrieved from http://www.econ.yale.edu/~shiller/pubs/p1089.pdf

Chen, R. D., Gan, C., Hu, B., & Chohen, D. A. (2013). An empirical analysis of house price bubble: A case study of Beijing housing market. *Research in Applied Economics, 5*(1), 77-97. doi:10.5296/rae.v5i1.3433

Dantzker, M. L., & Hunter, R. D. (2012). *Research Methods for Criminology and Criminal Justice* (3rd ed.). Jones & Bartlett Learning, Canada.

Dlamini, B. P. (2014). Exchange rate volatility and its effect on macroeconomic management in Swaziland. Retrieved from http://cmi.comesa.int/wp-content/uploads/2016/03/Swaziland.pdf

Duddy, J. (2010, July 6). Bank Windhoek drops prime rate. *The Namibian*. Retrieved from https://www.namibian.com.na/index.php?id=67976&page=archive-read

Duus, A., Hjelmeland, K. (2013). *Is there a bubble in the Norwegian housing market?* (Master's thesis, Copenhagen Business School, Denmark). Retrieved from http://studenttheses.cbs.dk/bitstream/handle/10417/3849/anette_duus_og_kathrine_hjelmeland.pdf?sequence=1

FinMark Trust. (2011). *Housing Finance in Africa: A review of some of Africa's Housing Finance Markets*. Retrieved from http://www.finmark.org.za/wp-content/uploads/2016/01/2011-housing-finance-in-africa.pdf

First National Bank. (2009). *FNB Housing Index: Houses prices price index climbs 4.6 bpts*. Retrieved from http://www.property.com.na/.../pdf/...index.../Housing_index_june09.pdf

First National Bank. (2012). *FNB Housing Index: House price fall marginally*. Retrieved from https://www.fnbnamibia.com.na/downloads/namibia/Housing-Index-Feb2012.pdf

First National Bank. (2013). *FNB Housing Index: Prices slowdown in March*. Retrieved from https://www.fnbnamibia.com.na/downloads/namibia/Housing-Index-Mar2013.pdf

First National Bank. (2015). *FNB Housing Index*. Retrieved from https://www.fnbnamibia.com.na/downloads/namibia/housingIndex/HousingIndex201509.pdf

First National Bank. (2016). *FNB Housing Index*. Retrieved from https://www.fnbnamibia.com.na/downloads/namibia/housingIndex/HousingIndex201606.pdf

Friedman, M. (1953). *The Case for Flexible Exchange Rates*: *Essays in Positive Economics*. Chicago University Press, Chicago.

Garner, T. I., & Verbrugge, R. (2009). Reconciling user costs and rental equivalence: Evidence from the U.S. consumer expenditure. Retrieved from https://www.bls.gov/pir/spm/spm_pap_rent_equiv08.pdf

Gathuru, J.W. (2012). *The effects of macroeconomic variables on the value of real estate supplied in Kenya* (Master's thesis, University of Nairobi, Nairobi, Kenya). Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/74930/Gathuru_The%20Effect%20Of%20Macroeconomic%20Variables%20On%20The%20Value%20Of%20Real%20Estates%20Supplied%20In%20Kenya.pdf?sequence=3

Gonzalo, J., & Pitarakis, J. Y. (2000). Lag length estimation in large dimensional systems. University of Reading, United Kingdom.

Gujarati, D. N. (2003). *Basic Econometrics* (4th ed.). The McGraw- Hill Companies, New York .

Halldorsson, E. (2016). *Models for asset price bubbles* (Master's thesis, Reykjavik University). Retrieved from https://skemman.is/bitstream/1946/26719/1/Models%20for%20Asset%20Price%20Bubbles.pdf

Hossain, B., & Latif, E. (2009). Determinants of housing price volatility in Canada: A dynamic analysis. *Applied Economics, 41*(27), 3521-3531. doi:10.1080/00036840701522861

IMF fears housing price bubble bust in Namibia. (2016, March 24). *New Era*. Retrieved from https://www.newera.com.na/2016/03/24/imf-fears-housing-price-bubble-bust-namibia/

International Monetary Fund. (2007). Namibia: Financial system stability assessment, including report on the observance of standards and codes on banking supervision. Retrieved from https://www.imf.org/external/pubs/ft/scr/2007/cr0783.pdf

Jantze, Z. (2017, August 24). Banks decrease interest rates. *Informante*. Retrieved from http://www.informante.web.na/banks-decrease-interest-rates.19825

Kaira, C. (2014, August 22). Banks increase lending rates. *The Namibian*. Retrieved from https://www.namibian.com.na/index.php?id=127145&page=archive-read

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. Palgrave Macmillan, United Kingdom.

Kgobetsi, C. D. (2017). *An analysis of factors influencing housing affordability in Windhoek, Namibia* (Master's thesis, University of Namibia, Windhoek, Namibia). Retrieved from http://repository.unam.na/bitstream/handle/11070/2054/kgobetsi_2017.pdf?sequence=1&isAllowed=y

Kim, H. Q., Mei, L. J., Yin, T. Y., & Niap, V. C. (2016). *Fundamental Determinants of housing price in Malaysia: Empirical and statistical investigation* (Thesis, Universiti Tunku Abdul Rahman, Malaysia). Retrieved from http://eprints.utar.edu.my/2035/1/FBF-2016-1205353.pdf

Lee, C. L. (2009). Housing price volatility and its determinants. *International Journal of Housing Markets and Analysis, 2*(3), 293-308. doi: 10.1108/17538270910977572

Lin, J. L. (2006). Teaching notes on impulse response function and structural VAR. Retrieved from http://faculty.ndhu.edu.tw/~jlin/files/impulse.pdf

Matongela, A. M. (2015). A quantitative investigation into determinants of house prices in Namibia. *Journal of Economics and Sustainable Development, 6*(4), 1-7.

Mayer, C. (2011). Housing Bubbles: A survey. *Annual Review of Economics, 3*(2011), 559-577. doi: 10. 1146/annurev.economics.0 12 809. 103822

Mhunduru, E. N. (2017, May 5). LTV regulation to curb mortgage lending dominance on loan books. *Windhoek Observer*. Retrieved from https://www.observer.com.na/index.php/business/item/8015-ltv-regulation-to-curb-mortgage-lending-dominance-on-loan-books

Miller, N., & Peng, L. (2004). Exploring Metropolitan housing price volatility. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.451.6389&rep=rep1&type=pdf

Ministry of Finance. (2011). *Macroeconomic Framework for the 2011/12 – 2013/14 Medium Term Expenditure Framework*. Retrieved from http://www.mof.gov.na/documents/27827/169978/Macroeconomic_Framework_2011.pdf/9922a349-900e-4127-8068-f6c4f5517b73

Mushendami, P., & Kandume, K. (2008). Investigating the role securitization could play in deepening the financial in Namibia. Bank of Namibia, Windhoek, Namibia.

Mwenje, G. (2015). *Macroeconomics determinates of housing prices in South Africa* (Master's thesis, Wits Business School, Johannesburg, South Africa). Retrieved from http://wiredspace.wits.ac.za/bitstream/handle/10539/18119/Grace%20Mwenje%20REPORT%203%20Final%20submission.pdf?sequence=2&isAllowed=y

Nakajima, M.C. (2011). Understanding house-price dynamics. *Business Review*. Retrieved from https://www.philadelphiafed.org/-/media/research-and-data/publications/business-review/2011/q2/brq211_understanding-house-price-dynamics.pdf

Nakashole, N. (2016, August 4). Angolan crisis hits Nam property market. *The Namibian*. Retrieved from https://www.namibian.com.na/154010/archive-read/Angolan-crisis-hits-Nam-property-market

Namibia Statistics Agency. (2017). *Preliminary Annual National Accounts 2017*. Retrieved from https://cms.my.na/assets/documents/Preliminary_National_Accounts_2017.pdf

Ngatjiheue, C. (2018, March 8). Non-performing loans swell to N$1,3b. *The Namibian*. Retrieved from https://www.namibian.com.na/64416/read/Nam-exports-under-Agoa-worth-N$23775m

Noord, P. V. D. (2005). Tax incentives and house price volatility in the Euro area: Theory and evidence. *Economie Internationale*, *101*(2005), 29-45.

Orsmond, D. & Price, F. (2016). Macroprudential policy frameworks and tools. Retrieved from https://www.rba.gov.au/publications/bulletin/2016/dec/pdf/rba-bulletin-2016-12-macroprudential-policy-frameworks-and-tools.pdf

Panagiotidis, T., & Printzis, P. (2015). On the macroeconomic determinants of the housing market in Greece: A VECM approach. GreeSE Paper No.88, the London School of Economics and Political Science.

Pettinger, T. (2012, June 9). House price inflation – Pros and cons. *Economics Help*. Retrieved from https://www.economicshelp.org/blog/5381/housing/house-price-inflation-pros-and-cons/

Pillaiyan, S. (2015). Macroeconomic drivers of house prices in Malaysia. *Canadian Social Science*, *11*(9), 119-130.

Reen, T. A., & Razali, M. N. (2016). The dynamics of house price volatility in Malaysia. *Journal of Technology Management and Business*, *3*(2), 14-35.

Savva, C. S., & Michail, N.A. (2017). Modelling house price volatility states in Cyprus with switching ARCH models. *Cyprus Economic Policy Review*, *11*(1), 69-82.

Sheefeni, J.P.S (2013). Testing for the fisher hypothesis in Namibia. *Journal of Emerging Issues in Economics, Finance and Banking*, *2*(1), 571-582.

Sheefeni, J.P.S (2015). Examining the bank specific determinants of profitability among commercial banks in Namibia. *Global Advanced Research Journal of Management and Business Studies*, *4*(6), 216-226.

Sjoling, B. (2012). *Indicators for bubble formation in housing markets* (Master's thesis, KTH Architecture and the Built Environment). Retrieved from https://www.diva-portal.org/smash/get/diva2:507630/FULLTEXT01.pdf

Stephens, M. (2011). Tackling housing market volatility in the UK. *Report*. Retrieved from https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/housing-markets-volatility-full.pdf

Sunde, T., & Muzindutsi, P. F. (2017). Determinants of house prices and new construction activity: An empirical investigation of the Namibian housing market. *The Journal of Developing Areas*, *51*(3), 389-407. doi: 10.1353/jda.2017.0080

The current volatility in house prices hurts the whole economy – we need solutions that will provide stability and affordability for home owners. (2011, May 24). Retrieved from http://eprints.lse.ac.uk/36423/1/blogs.lse.ac.uk-The_current_volatility_in_house_prices_hurts_the_whole_economy__we_need_solutions_that_will_provide_s.pdf

Tsai, I. C., & Chen, M. C. (n.d.). Modelling house price volatility states in the UK by switching ARCH models. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.524.3175&rep=rep1&type=pdf

Tu, Y., & Zhou, C. (2015). Exploring house price volatility in major Canadian cities. *Journal of Economic Literature Classification: C52, G10, R21, R3*. Retrieved from http://www.econ.queensu.ca/files/other/tu_zhou_20150118.pdf

Tupenaite, L., Kanapeckiene, L., & Naimaviciene, J. (2017). Determinants of housing market fluctuations: Case study of Lithuania. *Procedia Engineering, 172*(2017), 1169-1175. doi: 10.1016/j.proeng.2017.02.136

Verbrugge, R. (2008). The puzzling divergence of rents and user costs, 1980-2004. *Review of Income and Wealth, 54*(4), 671-699.

Vogelvang, B. (2005). *Econometrics – Theories and Applications with Eviews* (1st ed.). The Prentice Hall, Great Britain.

Walliman, N. (2011). *Research Methods: The basics* (1st ed.). Routledge, New York, United States of America.

Wang, Y. (2014). An economic analysis of housing market instability and affordability in China. *Undergraduate Economic Review, 11*(1).

Wickremasinghe, G. B. (2005). Efficiency of foreign exchange markets: A developing country's perspective. *Asian Academy of Management Journal, 10*(1), 1-17.

Williams, C. (2007). Research methods. *Journal of Business and Economic Research, 5*(3), 65-72.

Wilson, L., & Sheefeni, J. P. S. (2014). The relationship between interest rate and exchange rate in Namibia. *Journal of Emerging Issues in Economics, Finance and Banking*, *3*(1), 947-961.