EFFECT OF GOVERNMENT EXPENDITURES, MORTGAGE CREDIT AND PER CAPITA INCOME ON RESIDENTIAL HOUSE PRICES IN KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented for award of a degree in any other university.

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DEDICATION

To my high school economics teacher, the late Mr. George Ogola

ABSTRACT

Residential house prices in majority of global markets have been rising over the last decades in both nominal and real terms. Kenya's housing prices have increased over a short period of time. The period 2004 to 2017 marked unprecedented rise in house prices in Kenya. Specifically, house prices surged to KES29.8 million (US$287,367) in September 2017, from just KES7.1 million (US$68,467) in December 2000 – equivalent to about 4.2 times increase. For that reason, this research was motivated by the fact that more than 70% of households in Kenya are unable to purchase a residential house. This increase in house price relative to households' income has raised concerns about the causes of house price rise in Kenya. The extant researches on variables explaining the rise of house prices in Kenya have been descriptive in nature, with little inferential empirical evidence. Moreover, these researches have largely concentrated on macroeconomic variables such as National Income, input market variables such cost of construction and financial market variables such as inflation and interest rates. Little focus has been given to key housing sector players like the government, mortgage lenders and individual level incomes. The purpose of this study therefore was to examine the effect of government expenditure, mortgage credits and per capita income on house prices in Kenya. Specifically, the study sought to; determine the effect of government expenditure on residential house prices, examine the effect of mortgage credit on residential house prices, and analyse the effect of per capita income on residential house prices. The study was anchored on the inverse demand theory in a standard simultaneous equations model of demand and supply. Using correlational research design the study employed time series secondary data set for the period 2004 Q1 to 2017 Q4.Quarterlyhouse price data was collected from Hass Consult quarterly reports. Data on government expenditure and mortgage credits were collected from Central bank of Kenya quarterly reports and data on income was collected from Kenya National Bureau of Statistics quarterly reports. This study found out that in the long-run, government investment expenditure *($ß_1=0.23$, $p=0.0250$)*, government recurrent expenditure *($ß_2=0.08$, $p=0.0146$)*, mortgage loan *($ß_3 = 0.133144$, $p=0.0$)* have positive and significant effect on residential house prices in Kenya. While in the short run, government recurrent expenditure *($\alpha_1=0.04$, $p=0.0114$)*and individual income*($\alpha_2=1.14$, $p=0.0186$)* have positive and significant effect. Specifically, results of this study demonstrate that a 1% increase in government investment expenditure will cause a 0.23% increase in residential house prices; similarly a 1% increase in government recurrent expenditure will cause a 0.08% increase in of house prices in the long-run. In addition, in the long run, a 1% increase in mortgage credit will cause a 0.13% increase in residential house prices. This study further established that any deviation from the long run equilibrium is corrected at a speed of 40% in the next period. Government should focus on policies that increase house supply; while to investors, the speed of adjustment does not seem to encourage arbitrage profit. Finally, further studies are needed to better understand variation in prices for different kind of residential houses.

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ABBREVIATION AND ACRONYM

SDG	Sustainable Development Goals
KES	Kenya Shillings
GDP	Gross Domestic Product
CBK	Central Bank of Kenya
ADF	Augmented Dickey-Fuller
KPSS	Kwaitowski-Phillips-Schmidt-Shin Test
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model
OLS	Ordinary Least Squares

OPERATIONAL DEFINITION OF TERMS

Residential House Price is a measure of the value of residential houses. In this study, residential house price was measured using average residential house market selling prices.

Government Expenditure is a measure on the amount spent by government to purchase goods and services, which include public consumption and public investment.

Mortgage Credit is the transfer of an interest in property to a lender as a security for debt usually a loan of money.

Per Capita Income is the average income earned per person in a given area (city, region, country, etc.) in a specified year. It is calculated by dividing a country's a total income by its total population. Per capita income is often monitored as one of the many key economic indicators of purchasing power of households.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

A house is regarded as the significant asset of a household and an essential part of its portfolio (Panagiotidis, 2015). A residential house is considered to be a unique type of asset because it doubles up as consumption good and an investment (Glindro, et al., 2009). This is because of the positive trickle down effects in terms of social environment, public health and economic development (Panagiotidis, 2015). In low and middle income households, house purchase constitutes their largest expenditure (Zainun, et al., 2010) which makes a house an enormous source of wealth for these classes of households (Tilly, 2005). Although housing is a basic need (Ibem and Amole, 2010), a right (Kenya Constitution, 2010), large proportion of households do not have access to decent housing at affordable cost due to continuous rise in the price of residential houses creating a crisis in affordable housing (Schmuecker, 2011).

House prices have risen to unprecedented levels in majority of economies world over. This has put pressure on households especially the low and middle income earners. In order to explain house price growth, Vizek, (2010) noted that a number of studies on determinants of various factors explaining house prices have been carried out in developed economies. In recent past, research interests' in house prices have deepened because housing market is taunted to have played a major role in the global financial crises. However, the oscillating residential house prices do not only occur in developed economies but comparable or prominent price increases have been recorded in majority of developing economies.

Literature has documented several variables that explain the rising residential house prices. Macroeconomic variables such as gross domestic product, GDP (Borowiecki, 2009; Xu& Tang, 2014; Kibunyi, 2015; Cohen &Lina, 2017), financial factors such as inflation (Anari and Kolari, 2002; Zou&Chau, 2015) and bank lending (Davis and Zhu, 2004; Gerlach and Peng, 2005; Xu& Tang, 2014) have been studied. House-specific factors have been investigated, such as the vacancy rate (Barras, 2005) and construction lags (Spiegel, 2001; Barras, 2005). Structural factors, involving land, planning and tax systems over and above institutional and contractual characteristics of the national housing markets have been examined (European Central Bank, 2003). Yet according to these studies, these variables cannot fully explain this dramatic rise of residential house price, (Li, 2018).

Since previous variables have failed to fully explain the striking rise in residential house prices, other variables have been investigated. These variables include government expenditure, individual income and mortgage credit. Empirical investigations on the effect of total government expenditure on house prices have reported mixed results. Other scholars have reported positive effects (Afonso and Sousa, 2009; Li, 2018) while others have reported negative effect (Ruiz and Silva, 2016; Thai, 2016). Researchers have gone ahead and decomposed government spending into recurrent and investment spending and analysed their effect on residential house prices and reported mixed findings.

On one hand, researchers (such as Garcia et al., 2003; Chiang et al., 2012; Tai, 2016 and Li et al., 2017) have established positive effect of government investment expenditure on house prices. Conversely Garcia et al., (2003) have found a positive effect of government recurrent expenditure on housing prices while Thai, (2016) established a negative effect of recurrent expenditure on residential house prices. Emergent extant literature on residential house price changes in developed countries have failed to put forward a justification on the effect of

government expenditure on house price that can be easily generalised. It is against this backdrop that this study seeks to find out how government expenditure affects residential house prices in Kenya.

In addition, existing studies suggest that residential house price fluctuations are to a considerable degree explained by mortgage credit levels. Mortgage credit levels are likely to have a role in intensifying or diminishing the effects of macroeconomic shocks on residential house prices both at the local and national levels (European Central Bank, 2003). Over the past decade, both the mortgage market and residential housing sector have experienced a considerable growth.

The role of mortgage credit on asset prices and generation and house market bubbles have been of great concern for economists (Mian and Sufi, 2009; Brunnermeier, Eisenbach and Sannikov, 2012). In US housing market, many observers argued that reduced cost of credit and subsequent increased supply of credit were the main factors that fuelled increase in residential house prices in addition to the following reduction in residential house prices when mortgage credit dried up (Pavlov and Wachter, 2010; Mayer, 2011). However, other observers argue that that cheap mortgage credit on its own cannot fully explain the residential house price changes (Glaeser, Gottlieb, and Gyourko, 2010) implying that there are other factors to probably have been at play.

Adelino, Schoar and Severino (2012) portend that in considering the effect of mortgage credit on residential house prices, easier and cheaper in measuring the effect of credit on the price of housing, easier and cheaper reduces financial constraints on mortgage borrowers' thereby increasing demand for residential houses which in turn pushes up residential house prices. Conversely, increase in mortgage loans might be responding to increased residential housing

demand, consequently increasing residential house prices. In the latter situation, Adelinoet al (2012) posit that low-priced mortgage credit is not the source of increases in residential house prices, but house prices increase as a result of increase in demand for residential houses. From the foregoing, it would be interesting to find out how mortgage credit affects house prices for a developing country like Kenya.

Further, literature posits that residential house price changes are to a greater extent explained by changes in households' disposable income. For instant, Niu (2014) posit that residential house price has higher disposable income elasticity implying growth in residential house prices is positively influenced by growth in disposable income. According to price theory, a rise in personal income increases the demand for residential house and since residential house supply cannot increase in the short run, residential house price rises (Adams and Füss, 2010). Moreover, consistent rise in individual income may portray a higher life-time income thereby increasing households' willingness to spend larger percentage of their incomes on residential house purchase. As a result, a rise in individual income may be positively associated with rising residential house prices and conversely, a fall in individual income being associated with decrease in residential house prices (Agnello and Schuknecht, 2011). Contrary to the argument put forth, evidence indicates that personal income is negatively correlated with house prices (Zu and Tang, 2014).This is because in developed countries it is more sensible to rent a house than purchasing while in developing countries; households prefer to buy a house than rent (Zu and Tang, 2014). Therefore it is expected that growth in individual income results in growth in residential house prices in a developing country like Kenya.

Kenya is among the 190 countries who are dedicated to attainment of the Sustainable Development Goals (SDGs). Goal number 11 aims to "make cities and Human Settlements Inclusive, Safe, Resilient and Sustainable" (SDGs, 2016). This goal is informed by the fact

that at least 50% of the world's population in 2015 lived in urban settlements and that urbanization is growing in many developing countries. Target 1 of Goal 11 urges governments to "ensure for all adequate, safe and affordable housing and basic services and to upgrade slums." Despite of these targets, Kenya has continued to experience inadequate affordable housing attributed to unprecedented rise in house prices (Institute of Economic Affairs Kenya, 2017).

In a welfare state, a house is considered a basic good. Moreover, Kenyan constitution Article 43 (1) b explicitly points housing as a basic right that every Kenyan, has a "….right to accessible and adequate housing and to reasonable standards of sanitation" (Kenya Constitution, 2010). Supporting the constitution's call for adequate housing is the Vision 2030 which is Kenya's long term plan for economic and social transformation of the country. Consequently, in the face of such increase in house prices some social groups have been more affected, being excluded from the market and left without opportunity to afford decent and adequate housing can have implications for the rest of the market (Garcia et al., 2003).

HassConsult - a Kenyan real estate firm, records that residential house prices have continued to increase sharply from 2000 to 2017. According to HassConsult quarterly reports from 2004 to 2016 Q4, the average price of a house in Kenya pitched to KES31.1 million (US$307,100) in June 2016, from KES7.1 million (US$70,110) in December 2000 depicting an increase of 444.29%. According to a report by Cytonn (2018) in the last two decades, Kenya's residential housing market has witnessed an exponential growth as shown by the percentage share it contributes to Kenya's GDP which grew from 10.5% in 2000 to 12.6% in 2012 and 13.8% in 2016 (Cytonn, 2018). Figure 1 provides a better overview of the house price increase in Kenya.

Figure 1.1 Residential House price movements in Kenya from 2004-2017

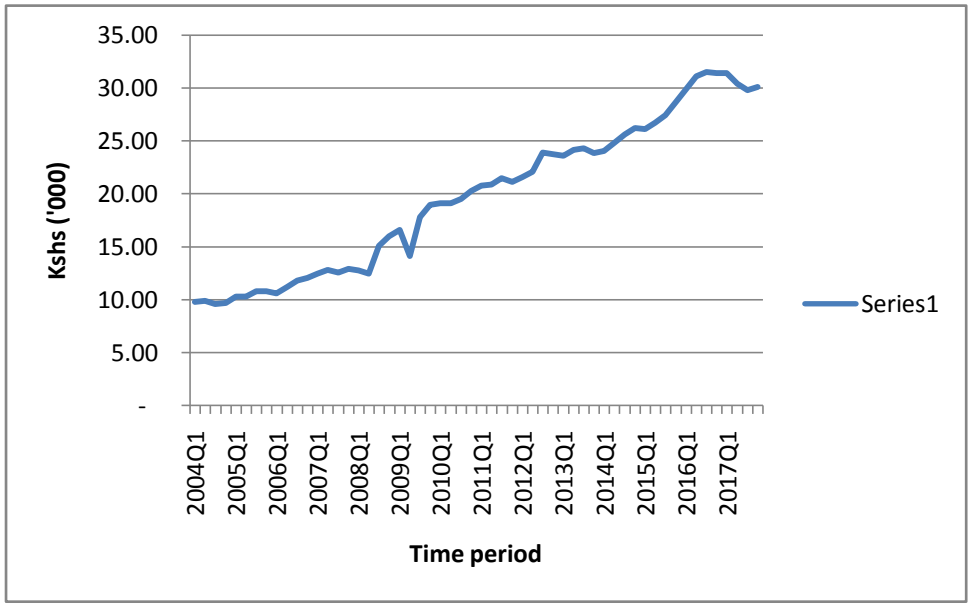

FIGURE 1/*Residential House Prices In Kenya*

Source: ***HassConsult Ltd, (2018)***

Despite the stellar contribution of housing market to GDP, majority of Kenya's in urban areas still spend a large portion of their income on rent. For instant Kenya national bureau of statistics (2018) reported that residents of Nairobi city spend 40% of their incomes on rent, which is way above the suggested 30%. This report further noted that in 2012 a residential house cost more than $15,000, which was 10 times more than the mean individual annual income of $ 1,340. And as at 2018, the average residential house price was $287,367 while in the same period, annual average individual income was $1,690.260. Moreover, residential houses available for lower income households are not enough and these houses do not promote quality life as Available lower income housing is not adequate and does not promote a quality of life that we want as confirmed by the huge numbers (6.4M) Kenyans who live in slums. That means that approximately 56% of urban population in Kenya live in slums.

The Central Bank of Kenya (CBK) annual supervision report (2016) state that Kenya's mortgage credit has grown in value from Kshs.19 billion in 2006 to just over Kshs. 219.9 billion by December 2016 reflecting a growth of 1,057.37%. In terms of mortgage numbers,

the figure according to CBK (2016) report grew to 24,085 in 2016 from 7,275 in 2006. Despite the growth in mortgage numbers, Kenya's mortgage industry is largely underdeveloped. For instant, according to global property guide (2018), Kenya's mortgage size was 3% of GDP as at 2016 which stands at a tenth of South Africa's, which is more than 30 per cent of GDP and the number of mortgage loans outstanding were at 25,000 - there were fewer than 25,000 mortgage loans outstanding – depicting how inaccessible mortgage finance is in Kenya.

According to World Bank (2016), Kenya has a population of about 48.46 million. As of 2017 estimates, Kenya had a GDP of 74.94 billion USD. Per capita GDP was estimated at $1,150. Despite the fact that Kenya is a leading Economy in East Africa, 53% of its population lives below the poverty line. Three quarters of the population is below 35 and the country is urbanizing at a rate of 4.3 percent per year. Urban centres face a shortage of 200,000 housing units annually whereas only 50,000 new housing units are being constructed every year. An estimated 61 percent of urban households live in slums (compared to 50 percent in Nigeria, 23 percent in South Africa). This elevated rate is mostly due to overcrowding and lack of access to basic services. In urban centres, 56 percent of households live in one single room, and only 19 percent own their home (Kenya National Bureau of Statistics, 2018).

Given the above Kenyan context, it is therefore of great necessity to investigate the variables explaining rising residential hose prices in Kenya as to provide policy recommendations. Additionally, unearthing what causes residential house price to increase becomes important in macroeconomic policies aimed at stabilizing the financial industry of any economy.

1.2 Statement of the Problem

The Kenyan residential house market has witnessed dramatic rise in prices for the last two decades when mean house prises rose to KES29.8 million (US$287,367) in September 2017, from KES7.1 million (US$68,467) in December 2000 –which is about 4.2 times increase. Extant reports show that this rise in residential houses prices relative to households' income has resulted in over 70% of urban households in Kenya experiencing housing affordability challenges. Existing studies posit that possible causes in rise of house prices are structural factors not in line with economic and financial factors. While others concluded that the rise in residential house prices is explained by macroeconomic and financial factors. Yet macroeconomic variables have not fully explained the rise in house price changes. In Kenya, extant researches on determinant of residential house prices have been descriptive in nature, with little inferential empirical evidence. Moreover, these researches have largely concentrated on macroeconomic variables such as gross domestic product, input market variables such cost of construction and financial market factors such as inflation and interest rates. Little focus has been given to key housing sector players like government, mortgage lenders and individual level incomes. Moreover, unlike developed countries, house prices in developing countries like Kenya have been less extensively researched. This has resulted in inadequate knowledge on critical variables affecting residential house prices in Kenya. Kenyan government spend large annual investments meant at enhancing quality of life of households in cities and towns. However, inferential empirical evidence on effect or relationship of government expenditure and house prices is lacking. Literature from developed economies has reported mixed evidence on the effect between government expenditure and house prices. It is therefore imperative to determine this relationship especially for a developing country. Secondly, given the heavy reliance on mortgage financing to finance residential house purchase, researchers have recorded mixed findings on

its effect on residential house prices with some authors recording that the effect of mortgage credit on residential house prices is stronger only when house prices are booming. Further, it is expected for house prices to react to shocks occasioned by individual income. On income at individual level, the extent of this effect has not been determined in Kenya despite the important role individual income plays in household wealth portfolio. Moreover, house price growth has outpaced individual income growth in the country.

1.3 Objective of the Study

1.3.1 General Objective

The intention of this study was to ascertain the effect of government expenditure, mortgage credit and per capita income on residential house prices in Kenya.

1.3.2 Specific objectives

i. To investigate the effect of government Investment expenditure on residential house prices in Kenya
ii. To investigate the effect of government recurrent expenditure on residential house prices in Kenya
iii. To analyse the effect of mortgage credits on residential house prices in Kenya
iv. To find out the effect of per capita income on residential house prices in Kenya

1.4 Research Hypothesis

This study was premised on the hypotheses below;

i. There is no effect of government investment expenditure on residential house prices in Kenya

H_0: $d_1 = 0$

ii. There is no effect of government recurrent expenditure on residential house prices in Kenya

H_0: $d_2 = 0$

iii. There is no effect of mortgage credits on residential house prices in Kenya

H_0: $d_3 = 0$

iv. There is no effect of per capita income on residential house prices in Kenya

H_0: $d_4 = 0$

H_1: $d_4 \neq 0$

1.5 Scope of the Study

This study centred on government expenditure, mortgage credit and household income and their effect on residential house price in Kenya at a macro-level. This implies variables of interest were measured at aggregate level. Time series data was collected for the period between $2004Q_1$ and $2017Q_4$. The period of the study was chosen because the period is characterised by rapid rise in residential house prices as compared to the periods before 2004. The study specifically focused on the residential housing prices in Urban Kenya due to data availability

1.6 Justification of the Study

This study will add to the body of knowledge in existence in the real estate field which will be beneficial to academicians. It may also provide a basis for further research in the field. Thus it will make a contribution to the literature on determinants of residential house prices.

Investors seeking to join the housing market may be able to make informed evaluation as to what is driving the changes in house prices and thus be able to make sound decisions. Individuals seeking to own their own homes may also benefit in understanding the market forces and make the best buy. Financing institutions may find this study useful in regard to fluctuations in prices since this affects the long term evolution of mortgage financing.

The government and regulatory bodies may benefit by adopting policies geared to stabilise the sector and hence formulate appropriate regulatory framework for enhancing the growth of the sector.

1.7 Theoretical Framework

Theoretical framework for this study was a typical simultaneous demand and supply equations representing the urban residential house consumption. The quantity variable is the existing residential houses made available for sale. The structural form of the model was given as

$$\text{Demand:} \quad Q_t = b_0 + b_1 Z_t + b_2 Y_t + b_3 P_t + u_{1t} \qquad (1.1)$$

$$\text{Supply:} \quad Q_t = a_0 + a_1 G_t + a_2 P_t + u_{2t} \qquad (1.2)$$

Where $Q_t$denotes house demand by households, $G_t$denotes government expenditure, $Z_t$denotes mortgage credit, Y_t denotes per-capita income and P_t denotes house prices. Both demand and supply equations will be approximated by equations linear in the logarithms of the variables.

Equations (1.1) and (1.2) are system of equations where Q and P are endogenous in the system. Assuming that Z_t, Y_t and G_t are determined outside this system, or functionally, that

they are uncorrelated with the disturbances u_{1t} and u_{2t} , then the reduced-form equation was estimated for the endogenous variables as functions of exogenous variables. The reduced-form equations were derived from solving the structural equations for the endogenous variables q_t and p_t.

$$p_t = d_0 + d_1 G_t + d_2 Z_t + d_3 Y_t + v_{1t} \quad (1.3)$$

$$q_t = r_0 + r_1 G_t + r_2 Z_t + d_2 Y_t + v_{2t} \quad (1.4)$$

Reduced-form equation of (1.3) was used to explain the rapid rise in the price of urban housing in Kenya by the forces of demand and supply.

Theory of demand and supply for residential house price determination assumes that the market for housing is always in equilibrium. A partial adjustment process was allowed by which the actual price p_t adjusts towards its equilibrium level p_t^* as determined by equation (1.3) by only a fraction d of the difference $p_t^* - p_{t-1}$in each period, the following equation was obtained to explain the change in p_t.

$$p_t - p_{t-1} = d(p_t^* - p_{t-1}) = d(d_0 + d_1 G_t + d_2 Z_t + d_3 Y_t) - d p_{t-1} \quad (1.5)$$

$$p_t = d(d_0 + d_1 G_t + d_2 Z_t + d_3 Y_t) + (1 - d) p_{t-1} \quad (1.6)$$

Equation1.5 and 1.6impliesthat the partial adjustment process is equivalent to an autoregressive (AR) process of p_t with government expenditures, mortgage credit and per capita income as exogenous variables. It also means that the parameters of equation (1.5) can be estimated by estimating the above AR process.

Similarly, if a partial adjustment process is assumed for the supply of housing stock q_t to adjust within a year by only a fraction$r$ to its equilibrium levelqt* as determined by the reduced form equation (1.4), then we have;

$$q_t - q_{t-1} = r(q_t^* - q_{t-1}) = r(r_0 + r_1 G_t + r_2 Z_t + d_2 Y_t) - r q_{t-1} \quad (1.7)$$

$$q_t = r(r_0 + r_1 G_t + r_2 Z_t + d_2 Y_t) + (1 - r) q_{t-1} \quad (1.8)$$

Based on the above reduced-form partial adjustment process, we can estimate the coefficients of equations (1.3) and (1.4) respectively by estimating equations (1.6) and (1.8).

Corresponding to the reduced-form partial adjustment processes, the demand and supply equations (1.1) and (1.2) also have their partial adjustment processes with the AR representations similarly defined as follows.

Demand:

$$p_t - p_{t-1} = d(p_t^* - p_{t-1}) = d(b_0 + b_1 Z_t + b_2 Y_t + b_3 P_t) - d p_{t-1} \quad (1.9)$$

$$p_t = d(b_0 + b_1 Z_t + b_2 Y_t + b_3 P_t) + (1 - d) p_{t-1} \quad (1.10)$$

Supply:

$$q_t - q_{t-1} = r(q_t^* - q_{t-1}) = r(a_0 + a_1 G_t + a_2 P_t) - r q_{t-1} \quad (1.11)$$

$$q_t = r(a_0 + a_1 G_t + a_2 P_t) + (1 - r) q_{t-1} \quad (1.12)$$

Denoting the predicted value of p_t from equation (1.3) by p_t^*, *we* estimated the coefficients of reduced-form equations (1) and (2) respectively by estimating equation 1.3.Equation 1.3 formed theoretical framework for this study. The above theoretical framework for house price determination assumed that the market for housing is always in equilibrium.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the theory that underpins this study. Empirical literature concerning determinants of urban residential house prices is also reviewed. The purpose is to give cognizance to what other researchers have done in understanding housing price dynamics.

2.2 Theoretical Review

The price theory has been widely used in modelling house price dynamics. Since this study is concerned with house price dynamics, a review of the price theory is justified.

2.2.1 Demand Theory

Demand theory also known as theory of price propounded by Adam Smith (1776) states that the price for any specific asset is based on the relationship between its demand and supply. Price theory as typically defined (Hammond et al., 2013) is the analysis of price-taking behavior in partial equilibrium. The interaction between supply and demand aims at achieving a stable price (equilibrium) where quantities of services or goods supplied corresponds to the markets' willingness and ability to want to obtain the good or service.

According to Ge and Runeson (2006), in neoclassical economics, price determination is based on scarcity, consumption and production of goods and service and their corresponding assumptions. Given the nature of residential housing, their supply remains fixed in the short run. This implies that supply of residential hoses takes a longer time which makes housing supply lags behind residential housing demand (Omar & Ruddock, 2002). Given the

important role time element plays in equilibrium price determination, this study will adopt a dynamic equilibrium analysis of house prices. This is because dynamic equilibrium analysis shows the path of change. Dynamic analysis also shows the process by which equilibrium is achieved, and it studies both equilibrium and disequilibrium.

The decision to buy a residential house depends on access to mortgage credit and household disposable income. For instant, according to Ge and Runeson (2006), household mortgage credit and household disposable income as a result play a key function in influencing demand for residential houses because of the dual benefits of a residential house both as consumption good and as an investment. Their assertion means that residential house demand increases when house prices decreases and therefore in the short run, continuous increase in house prices reduces households' ability to afford a house. In the short-run, constant rise in residential house prices diminish household's capacity to pay for housing and as a result residential house price will decrease when demand for houses decreases and the converse is true. Inadequate supply of residential houses can cause house prices to increase, but in the long run as demand for houses increases, supply of houses will be increased (GeandRuneson, 2006). The important conclusions are that residential house price growth are caused by inadequate supply while house price decrease is caused by surplus of residential houses.

2.3 Empirical Literature

2.3.1 Government Expenditure and House Prices

Garcia, Matas, Montolio, Raya and Raymond (2003) examined the effect of local public spending on house prices for the city of Barcelona in Spain for the period 1998-2001. The researchers considered hedonic house while public expenditure included both recurrent and development expenditures but at city level. Using a two-stage econometric model, based on

the classical hedonic price model, they demonstrated that government recurrent expenditure has a bigger effect on housing prices than government investment expenditure which nonetheless has a positive and significant relationship. Their result implies that lagged values of total government spending have a positive effect on housing prices.

Afonso and Sousa (2009) in a working paper series no. 990 of the European Central Bank investigated the link between government spending and house prices using a fully simultaneous system approach in a Bayesian framework. The researchers used quarterly data in natural logarithms from the U.S., the U.K., Germany, and Italy respectively for the periods 1970:3-2007:4; 1971:2-2007:4; 1979:2-2006:4; 1986:2-2004:4. Result of their study indicated that primary government expenditures have a persistent positive influence on residential house prices; however, residential house price changes are experienced after the fourth quarter.

A study by Chiang, Choy and Li (2012) examined the effect of public expenditures on house prices in Shanghai China. The researchers performed co-integration analysis based on annual time series dataset for the period 1991-2009. The authors considered residential house price index as explained variable while government investment expenditure as explaining variable. Housing investments and land sale revenues were considered as control variables. Using co integration and error correction model, the empirical results of this study indicate that government investments expenditure and residential house price movements in Shanghai were positively co-integrated from 1992 to 2009, suggesting that increased public expenditure has affected Shanghai's house prices.

Extant researchers have suggested that under different types of market, government expenditure capitalization effect on house prices is mixed. Ruiz and Silva (2016) empirically explored the effect of total government spending on house prices in US. In their study, they employ time series quarterly frequency and cover the period 1963:Q1–2011:Q4. The result of vector autoregressive model indicated that gross government consumption expenditures & gross investment have a very persistent negative effect on house prices.

Thai (2016) investigated whether government spending is an important driving force of a recent increase in housing price in Vietnam. Using a Vector Autoregressive Model approach with a unique quarterly dataset of the 2011-2015 period from two biggest and most important cities of Vietnam (Hanoi and Ho Chi Minh), the results show that an increase in government investment expenditure instead of the recurrent expenditure or other government spending pulls up housing price. Interestingly, the study revealed that the lagged recurrent spending or total government expenditure has a negative impact on current house prices.

Li, Wang, Deng, Shi and Wang (2017) provide further evidence on this interaction. These researchers used data from different geographic locations in Shanghai, China. In order to find out how government expenditure associates with residential house prices, the researchers employed a multilevel research design. This study's dependent variable was average house price per square meter expressed in logarithm form. Monthly data employed were for 2010-2012was used. The explained variable in this study was the log of the mean value of residential house price per square metre. The data used in the study was for each sales transaction that occurred between January 2010 and June 2012 in Shanghai. The Results of this study concluded that aggregate government expenditure at the urban level does not affect

residential house prices in Shanghai. On the contrary, government investment expenditure positively influence residential house prices in a statistically significant way.

Li, (2018) carried out a study to investigate how public expenditure influences residential house price in China. The paper performed empirical test and analysed panel data for the period 2007-2015 for 30 different provinces in China. The paper considered the residential house selling price as the study variable and the municipal government spending as independent variable. Land prices, urban population, number of houses built to completion, per capita disposable income, and loan rate for purchasing house were considered as control variables. In a static panel test, the result indicates that public expenditure has prominent capitalization effect on house price.

From literature, evidence is still inconclusive on the effect of government expenditure on house prices. This can be seen from the conflicting results from different studies cited above. Given that these studies are country specific, these results cannot be generalised, and as such there is need to investigate how government expenditure may influence house prices in a developing economy. This study contributes to literature by providing evidence of the role of government spending on housing price in Kenya.

2.3.2 Individual Income and House Prices

Capozza et al (2002) examined determinants of real house price dynamics. The researchers explored persistency and sustainability of house price changes in Spain using panel data from 62 urban areas using annual data from 1979 to 1995. In particular, the researchers establish that in the long-run, real average residential house prices directly related to real average individual income. The coefficients on real individual income suggest that a one percent increase real individual income causes a half percent increase in residential house prices.

Jacobsen and Naug (2005) studied the determinants of house prices in Norway. Using ECM on quarterly time series data for the period 1990-2004 they established that household's income has a positive and statistically significant effect on residential house price in the long-run. Given the fact that in the short run, house supply is inelastic, an increase in disposable income is expected to result in disequilibrium.

Barot and Yang (2002) estimated determinants of residential house prices for Sweden and United Kingdom. These researchers used a quarterly data ranging from 1970 to 1998 as their sample. A correlation research design was used and data analysed in an Error Correction framework. The study established that income determines house prices in the long-run for both countries. Further, any deviations from the equilibrium price are corrected at a speed of 0.12 for Sweden and 0.23 for the United Kingdom. On direction of causality, the study reported that individual income granger causes residential house prices for Sweden which is a unidirectional causality while for the United Kingdom; the study established a bi-directional causality between income and residential house prices.

Barksenius and Rundell (2012) sought to examine what drives Swedish house price changes. The researchers estimated an Error Correction Method (ECM) using quarterly data for the period 1987 to 2011. The authors found out that disposable income is a significant factor in determining residential house prices. Specifically, the researchers find that a 1% increase in households' disposable income will lead to a 0.41% increase in nominal house prices.

Gallin (2006) studied long-run house price and income in the US across 95 metro areas covering 23 years. Using a panel-data, the researcher tested for cointegration and the failed to the null of no cointegtation. This result means that house prices have no stable long run

relationship with the level of income contradicting many in the housing literature. However this does not mean that income does not affect house prices.

Lu & Tang (2014) examined the factors explaining growth of UK house prices. The researchers applied ashort- and the long-run models. In order to achieve their objective, the researchers used quarterly time series data for the period 1971Q1-2012Q4. From the analysis of data, the researchers concluded that disposable income has a negative effect on residential house price in UK. On the contrary, in the short-run, disposable income was found to affect residential house prices positively in a statistically significant way while in the long run, the effect is negative. Their findings contradict that of Capozza et al., (2002) and Barksenius and Rundell (2012). In justifying their findings, Lu & Tang (2014) explained that households in UK prefer to rent a house than buy and that they would rather spend their incomes on other things that buying a house for speculation.

2.3.3 Mortgage Credit and House Prices

Insights into the role that mortgage loans plays in the economy have attracted a lot of research. The feedback effects between house prices and credits have been documented. For instant, Gerlach and Peng (2005) studied how private sector loans (proxy for mortgage credits) correlates with residential house prices in Hong-Kong. Gerlach and Pen employed a time series data for the period between1984-2001. A correlational research design was adopted. Data was analysed in an error correction framework to determine both the short and long run effects. Their results showed that in the long run, increase in mortgage credit causes increase in residential house prices. Implying that the direction of causation was unidirectional and that changes in mortgage credit does not cause changes in house price.

Using single-equation approach, Fitzpatrick and Mcquinn (2007) study the relationship between house prices and mortgage credit for Irish economy. To achieve their objectives, these researchers model residential house prices as explained variable and residential mortgage credit as explaining variable. Using a number of econometric approaches, they record that in the long run, residential mortgage and residential house prices reinforce each other, implying a bi-directional relationship. However, they find that house prices do not affect mortgage credit at the same time in the short run, a finding that is contrary to that of Gerlach and Peng (2005).

This contrasts in some way with the findings of a country-specific analysis by Brissimis and Vlassopoulos (2009). Brissimis and Vlassopoulos used quarterly time series data for the period between 1993:Q4-2005:Q2. The researchers apply multivariate cointegration techniques to establish direction of causation involving mortgage credit and house price in Greece. The researchers found that in the long-run mortgage credit has no effect on house price. On the contrary, they established that mortgage credit has a short-run effect on house price.

Oikarinen (2009) explored the relationship between residential house prices and household loan in Finland. The researcher used quarterly data for the period between 1975 and 2006. Using cointegration approach, a Johansen cointegration analysis found out that there is only one cointegrationg relationship and that household borrowing affects residential house prices positively.

In another country-specific study, Gimeno, & Martínez-Carrascal (2010) in Spain carried out analysis on the relationship between mortgage loans and house prices with the aim of finding out any deviations from this long run relationship and how such deviations are corrected.

Making use of quarterly data for the 25 year sample period ending $2009Q_1$ they found out that in the long run house prises positively affect mortgage loans. In addition, when mortgage loans are above their stable level, then mortgage loans affect positively affect house prices and consequently, house prices and mortgage credits reduce. Concerning speed of adjustment, this study found out that the speed of correction is very slow implying that to correct residential house price increase due to increased mortgage credits takes an extended time.

Anundsen and Jansen (2013) estimated the relationship between residential house prices and household borrowing in Norway. These researchers employed a similar explanatory variable like Oikarinen (2009). Their time series data were quarterly for the period 1984-2009. Using simultaneous equations, they established a long run relationship within a cointegrated vector auto regression in real housing prices. Variable of interest were disposable individual income and household borrowings expressed in real terms while controlled by after tax interest rate, the number of house transactions and the volume of housing capital. Their findings indicate that there exist a bi-directional relationship between disposable individual income and household borrowings in Norway.

Turk (2015), sought to establish the relationship between housing price and household debt for the Swedish economy. Turk used quarterly data for the period 1980Q1 to 2005Q1. His variables of choice included housing price, household disposable income, and household debt. Using a three-equation in an error correction model, the researcher found that in short-period household debts cause residential house prices, however, in the long run, house price increase cause increase in household debts. This study further ascertained that house price and household loans deviated from their long-run equilibrium and the speed to adjust this deviation is very slow, a finding similar to that of Gimeno, &Martínez-Carrascal (2010).

More recently, Sara Filipe (2018) investigated the relationship between house price index and mortgage loans in Luxembourg using time series data ranging from $1980Q_1$ to $2016Q_3$.In a vector error correction model, the researcher established the effect of mortgage loans on residential house prices and the direction of causality between the two variables. The study findings indicate that increasing house prices has a direct long-run effect on mortgage credit, consequently leading to increase in residential house prices. The results of this study can be concluded to support the mutual dependence hypothesis of mortgage loans and residential house prices.

From the above review, it is evident that there is a positive relationship between credit and house prices. However, the short run and long run effects and the direction of causality of that relationship are still debatable. It would be important to fill these gaps by looking at the short run and long run relationship between residential mortgage credits and house prices in a developing economy like Kenya since most of these studies have only focused on developed economies.

2.4 Overview of Literature

A large body of research agree on the explanatory power of parameters of each residential house price determinant. However, when it comes to making a distinction on the direction of association of each explaining variable and their signs equivalent to economic theory, there is a disagreement. Elasticity of residential house price relating to its explanatory variables varies extensively. These elasticities depend on a country's data, study period and methods used in research. Additionally, many researchers fail to establish both short term and long term relationship thus the relative explanatory importance remains unidentified. This study therefore, seeks to examine both short term and long term relationships.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives the methodology that was applied in the study. It describes the planning of this thesis that undertook to establish effect of government expenditure, mortgage credit and per capita income on residential house prices in Kenya. Specifically, this chapter discusses the Research Design, Study Area, Data Sources and Measurement, Model Specification and Data Analysis techniques that were used in the study.

3.2 Research design

This study was based on correlational research. Correlational research design is the investigation of effect relationships (Crawford, 2015). This design is considered appropriate for this study because this study seeks to establish effect of government expenditure, mortgage credit and per capita income on residential house prices in Kenya. Therefore this research design provides a clear blue print to test the research hypotheses.

3.3 Study Area

Kenya is located on the eastern Africa. Kenya borders Somalia to the east, Ethiopia to the north, Tanzania to the south, Uganda to the west, and Sudan to the northwest. Kenya has a population of 51.39 million, a GDP per Capita of $ 1,816.5 (World Bank, 2018). Additionally, annual housing demand is at 250,000 units and supply stands at 50,000 units (Kenya, Bankers Association, 2018).

3.4 Data Sources and Measurement

This study employs three blocks of explanatory variables based on theoretic reasoning or previous empirical work. The first block of explanatory variables are demand-side factors including, house prices, mortgage credit and household disposable income. The second blocks of variables are supply-side factors, including public investment expenditure, government recurrent expenditure and house prices.

Residential house prices were sourced from HassConsult, a real estate firm in Kenya. The independent variables (Government expenditure, Mortgage values and Per Capita Income) were sourced from CBK Statistical Bulletins and bank supervision reports.

House price was the quarterly nominal value from the HassConsult all properties series. The Hass Composite Price Index was a representative of all properties for sale in Kenya. Mortgage Loan was measured from the quarterly value of credit from banks for house purchase. GDP per capita was measured by dividing Kenya's **GDP** by its population. Government expenditure was the quarterly expenditures incurred by the government over the study period. All variables were measured in Kenya Shillings. Moreover, all variables were seasonally adjusted and expressed in logs.

3.5 Model Specification

From the theoretical framework (1.7) and anchored in literature review, the following model was specified, encompassing three variables that have potentially effects on Kenya's residential house prices. The specification of the regression model 3.1 is based primarily on theoretical framework given in 1.7. Denoting the predicted value of $p_t$from equation (1.3) by

p_t^*, *we* estimated the coefficients of reduced-form equations (1) and (2) respectively by estimating equation 1.3 hereunder referred to as equation 3.1

$$\boldsymbol{P_t^* = d_0 + d_1 G_{t1} + d_2 G_{t2} + d_3 Z_t + d_4 Y_t + v_t} \qquad \textbf{(3.1)}$$

Where, P^* is equilibrium house price, G_1 is government investment expenditure, G_2 is government recurrent expenditure, Z is mortgage credit and Y is per capita income.

3.6 Data Analysis

Descriptive statistics of Mean, Median, Standard Deviation, Skewness, Kurtosis and Jarque-Bera were analysed. These analyses were performed using E-Views. In addition, Unit Root tests, Cointegration and Vector Error Correction estimation were done.

3.6.1 Unit root (Stationarity) test

Unit root tests were performed to determine stationarity of the time series under consideration. Brooks (2008) revealed three grounds why it was imperative to find out whether variables are stationery or not: (i) any shock on non-stationary variable tends to have a permanent effect that cannot be reversed; (ii) in a standard ordinary least squares test, non-stationary variable can falsely appear to be statistically significant leading to a false conclusion (spurious regression); (iii) any data that is non-stationary will deviate from the normal t-and F-distributions when testing for their significance. In order to provide a robust unit root test, this study utilized two dissimilar unit root tests.

3.6.1.1 Augmented Dickey-Fuller

The Augmented Dickey-Fuller (ADF) test (1979) model was expressed as below:

$$\Delta y_t = \psi y_{t-1} + \lambda t \sum_{t-1}^{p} \Delta y_{t-1} + e_t \qquad (3.2a)$$

$$\Delta y_t = \mu_1 + \psi y_{t-1} + \lambda t \sum_{t-1}^{p} \Delta y_{t-1} + e_t \qquad (3.2b)$$

$$\Delta y_t = \mu_1 + \mu_{2t} + \psi y_{t-1} + \lambda t \sum_{t-1}^{p} \Delta y_{t-1} + e_t \quad (3.2c)$$

Where μ = intercept and *t*is trend, respectively.

The three equations above points to the presence of deterministic elements λ *and* ψ. 3.2a involves random walk model, 3.2b includes an intercept and 3.2c includes both intercept and trend. The null hypothesis for ADF tests is that the time series data contain a unit root. Since the actual data-generating process is unknown, model 3.2c was used to test ADF hypothesis (Nyongesa, 2017).

3.6.1.2 Kwaitowski-Phillips-Schmidt-Shin (KPSS) test

When the sample size is less than 250 KPSS a better test for stationarity (Zu and Tang (2014) as it can directly tests the stationarity (Arltová&Fedorová, 2016). The null hypothesis for KPSS test (1992) is that the data is stationary and it is given as

$$KPSS = \frac{1}{T^2} \sum_{t=1}^{T} \frac{S_t^2}{S^2\ (K)} \quad \textbf{(3.3)}$$

Where $S_t = \sum_{i=1}^{t} e_i \qquad t = 1,2,3, \ldots T$

$$S^2 = \frac{1}{T} \sum_{t=1}^{T} e_t^2 + \frac{2}{T} \sum_{s=1}^{K} (1 - \frac{S}{(K+1)}) \sum_{t=s+1}^{T} e_t\ e_{t-s}$$

$e_{i=}$residuals

T = total observations and

K = lag length.

3.6.2 Lag length Selection

One critical element in VAR analysis is the lag length. This is because, as noted by Nyongesa (2017), interpretation of model estimates can be affected in a major way if there is a large difference in lag orders. From existing literature, Lag length is selected based on a number of criterions. The commonly used criteria are Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion, measured as defined below;

$$AIC_{(p)} = \log\det(\sum\nolimits_{u}^{\sim}(p)) + \frac{2}{T}pK^2 \quad (4.1a)$$

$$HQ_{(p)} = \log\det(\sum\nolimits_{u}^{\sim}(p)) + \frac{2\log(\log T)}{T}pK^2 \quad (4.1b)$$

$$SC_{(p)} = \log\det(\sum\nolimits_{u}^{\sim}(p)) + \frac{\log(T)}{T}pK^2 \quad (4.1c)$$

$$FPE_{(p)} = (\frac{T+p^*}{T-p^*})^k \log\det(\sum\nolimits_{u}^{\sim}(p)) \quad (4.1d)$$

With $\sum_{u}^{\sim}(p) = T^{-1}\sum_{t=1}^{T}\hat{u}_t\ \hat{u}_t'$ and p^* is the total number of parameters in each equation and p assigns the lag order. A lag order chosen must minimise the value of the criterion over a range of alternative lag orders p given by ($p: 1 \leq p \leq p^*$).

3.6.2 Cointegration Test

This study used the Johansen's Method to test for cointegrating equations because Johansen's method accorded the opportunity to establish more than one cointegrating equations among the variables of the study (Maggiora, 2009). In this situation, Johansen's Method better suits the data, because it can treat all test variables as endogenous (Asteriou, 2007).

3.6.3 Vector Autoregressive Model

Cointegration analysis begun by estimating VAR model for order 1 below:

$$lnP_t = \theta + \sum_{i=1}^{k}\beta_i lnP_{t-i} + \sum_{j=1}^{k}\emptyset_j lnG_{t-j} + \sum_{m=1}^{k}\varphi_m lnY_{t-m} + \sum_{n=1}^{k}\delta_n lnZ_{t-n} + \mu_{1t} \quad \textbf{(3.4)}$$

The dependent variable is a function of its lagged values and the lagged values of other variables in the model. In general, VAR (p)model for q difference data was characterized as;

$$lnP^* = C_i + \sum\sum_{j=1}^{k}\xi lnP_{t-j,i}^* \quad \textbf{(3.5)}$$

$$lnP^* = C + \sum_{i=1}^{k}\psi_i \ln P_{t-1}^* + \mu_t \quad \textbf{(3.6)}$$

Where:

P^*: is $4x1$ vector of variables $I(1)$

ψ_i: is a $4x4$ matrix containing the autoregressive coefficients, for i=1,2,....p

k: is the lag length

c: is a $4x1$ vector intercept

μ_t: is a $4x1$ vector of innovations

3.6.4 Vector Error Correction Model

Vector Autoregressive (VAR) is one of the special forms of system simultaneous equation (Usman et al., 2017). When non-stationary data have cointegration relationship, then a VECM is used (Enders, 2015). VECM was preferred in this study since it estimated both the short term effect and the long run effect of the time series data. In addition, even if there was only one co-integrating relationship; it was still possible to estimate speed of adjustment coefficient. To obtain a VECM, the VAR model above was differenced. Hence the VECM was as follows:

(3.7)

$$\Delta lnP_t = \theta + \sum_{t=1}^{k} \beta_i \, \Delta lnP_{t-i} + \sum_{j=1}^{k} \emptyset_j \Delta lnG_{t-j} + \sum_{m=1}^{k} \varphi_m \Delta lnY_{t-m} + \sum_{n=1}^{k} \delta_n \Delta lnZ_{t-n} + \pi_1 ECM_{t-1} \ \ldots$$

$\boldsymbol{k}$= the lag length

$\boldsymbol{\theta, \beta, \emptyset, \varphi \, and \, \delta}$ = short-run dynamic coefficients of the model

$\boldsymbol{\pi}_i$ = the speed of adjustment parameter with a negative sign. Measures the speed at which P returns to equilibrium after changes in $G, Y \, and \, Z$

$$ect = lhprice_{t-1} - \beta_2 lgovinv_{t-1} - \beta_3 6lgovrec_{t-1} - \beta_4 lmortloan_{t-1} - \beta_5 lpcapin_{t-1}$$

ECT_{t-1} = lagged OLS residual obtained from the long-run cointegrating equations

The ECT explains that previous period's derivation from the long-run equation influences short-run movement in the dependent variable

μ_{it} = residuals (stochastic error terms)

3.7 Assumptions of the VAR model

3.7.1 Normality Test of the Residuals

Test for normality was done to confirm if the residuals exhibit a normal distribution (Usman et al., 2017). To this end, Jacque-Bera test was employed. Jacque-Bera measured the disparity between kurtosis and skewness and was then compared to that of normal distribution (Jarque and Bera, 1980).

Jacque-Beranull hypothesis was set as follows:

H_0: Residual normal distribution

3.7.2 Heteroscedasticity test

Heteroscedasticity was done to establish consistency of variance of the residuals. This was achieved using Engle's Arch LM test (Engle, 1982) with null hypothesis as below;

H_0: There is no heteroscedasticity.

3.7.3 Serial Correlation Test

The test procedure was as follows:

H_0: No serial correlation

3.8 Data Presentation Techniques

The results of the data analysis were then presented in tables and graphs.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter outlines the findings of this study. Analysis of descriptive statistics, time series properties of stationarity, correlation, cointergration and vector error correction of the series in the study are presented in this chapter. Further, both short run and long run effects of variables of this study are reported. Thereafter detailed discussions of the study findings are presented.

4.2 Descriptive Statistics Analysis

This was done in order to understand quantitative insights across the variables. These insights included mean, standard deviation, skewness, and kurtosis. In addition, the results of analysis of maximum and minimum values of each series are also reported. These features are presented in table 4.1.

TABLE 1: DESCRIPTIVE STATISTICS RESULTS

	GI	GR	HP	ML	PI
Mean	328136.1	1020002.	19.75232	135278.2	0.019471
Median	199847.4	723362.0	20.54500	101700.0	0.019518
Maximum	1683671.	3935631.	31.50000	366500.0	0.023142
Minimum	14107.21	76033.17	9.600000	19700.00	0.016404
Std. Dev.	357902.4	850907.7	7.176060	117844.8	0.001988
Skewness	1.778862	1.404550	0.075906	0.634733	0.258675
Kurtosis	6.120668	4.736240	1.695007	1.969890	1.844456
Jarque-Bera	52.25727	25.44634	4.027460	6.236227	3.740177
Probability	0.000000	0.000003	0.133490	0.044241	0.154110
Sum	18375624	57120104	1106.130	7575580.	1.090361
Sum Sq. Dev	7.05E+12	3.98E+13	2832.271	7.64E+11	0.000217
Observations	56	56	56	56	56

Source: *Researcher, 2019*

Analysis of the data revealed that the mean government investment (GI) expenditure was Ksh. 328, 136.1M, with a minimum spending of Ksh14107.21M and a maximum spending of Ksh1,683,671M. GI had a positive deviation of 1,669,563.79 between them indicating increasing rate of government spending. In addition GI distribution appeared to be skewed to the right (+1.78) depicting a lognormal distribution and kurtosis coefficient (6.12) of GI is *leptokurtic* indicating that probability mass is concentrated around the mean.

Analysis of the data revealed that the mean government recurrent (GI) expenditure was Ksh. 1,020,002, with a minimum spending of Ksh76,033.17M and a maximum spending of Ksh3,935,631M.GR had a positive deviation of 3859597.83M between them indicating increasing rate of government spending on recurrent expenditure. In addition GR distribution appeared to be skewed to the right (+1.40) depicting a lognormal distribution and kurtosis coefficient (4.74) of GI is *leptokurtic* indicating that probability mass is concentrated around the mean.

Analysis of the data revealed that the mean house price (HP) was Ksh. 19.75232M with a minimum price of Ksh9.6M and a maximum price of Ksh31.5M.HP had a positive deviation of 21.9M between them indicating increasing rate of residential prices in Kenya. In addition HP distribution appeared to be skewed to the right (+0.075906) depicting a lognormal distribution and kurtosis coefficient (1.69) of HP is *leptokurtic* indicating that probability mass is concentrated around the mean.

Analysis of the data revealed that the mean mortgage loan (ML) was Ksh. 135,278.2M.ML had a positive deviation of 346,800 between them indicating increasing rate of residential prices in Kenya. In addition ML distribution appeared to be skewed to the right (+0.634733)

depicting a lognormal distribution and kurtosis coefficient (1.969890) of HP is *leptokurtic* indicating that probability mass is concentrated around the mean.

Given the fact that all the variables were not normally distributed, it implied that they were log-normal. Therefore, analysis on the series was carried out on the logarithm of the observations in order to make the distribution normal.

4.3 Correlation Analysis

Table 4.2 is a presentation of correlation coefficients associating house prices in Kenya to government expenditures, mortgage credit and per capita income. House price has a strong positive correlation with government investment expenditure [0.603503], government recurrent expenditure [0.608015], mortgage loans [0.954732] and per capita income [0.971973], all significant at 5% level signifying a linear association between the dependent variable and the independent variables.

Table 2/Correlation Matrix

Correlation t-Statistic Probability	GOVINV	GOVREC	HPRICE	MORTLOAN	PCAPIN
GOVINV	1.000000 ----- -----				
GOVREC	-0.109260 -0.807729 0.4228	1.000000 ----- -----			
HPRICE	0.603503 5.561874 0.0000	0.608015 5.627699 0.0000	1.000000 ----- -----		
MORTLOAN	0.611414 5.677860 0.0000	0.633181 6.011487 0.0000	0.954732 23.58520 0.0000	1.000000 ----- -----	
PCAPIN	0.604483 5.576107 0.0000	0.629583 5.954792 0.0000	0.971973 30.38169 0.0000	0.973615 31.35235 0.0000	1.000000 ----- -----

The first statistic in each pair is the correlation coefficient. The second is the t-statistics and the third statistics is the p-value at 5% level of significance.

Even though correlation coefficients show existence of association between the variables of interest, this does not prove any cause and effect relationship between the variables. Correlation established provided a platform to estimate the econometric model of this study.

4.4 Results of Data Analysis

4.4.1 Stationarity Test

Before carrying out the empirical analysis of cointegration and error correction model, stationarity of time series was tested. Both the ADF test (1979) and the KPSS test (1988) were run to determine the stationarity of the five series namely: government investment expenditure, government recurrent expenditure, mortgage credit residential house price, and individual income. The reason for the joint tests is outlined in the methodology section 3.6.1.

ADF test takes the form of equation (3.2c). From the results summarised in table 4.4,null hypothesis of non-stationarity was rejected at $\alpha = 0.01$ significance level at first differences. The results suggest that all series are stationary at I(1) as shown in table 4.3a

Table 3/ADF Unit Root Test

	LOG	GOVREC	GOVINV	HPRICE	MORTLOAN	PCAPIN
Null Hypothesis: Contain a unit root						
Level	ADF test (P-values)	1.068100 (0.7217)	1.86625 (0.3450)	1.016892 (0.7412)	0.286858 (0.9198)	0.161256 (0.9676)
	Critical Values (5% level)	-2.918778	-2.92378	-2.915522	-2.915522	-2.915522
1st Difference	ADF test (P-values)	14.76352 (0.0000)	5.217599 (0.0001)	8.91635 (0.0000)	8.63019 (0.0000)	7.421891 (0.0000)
	Critical Values (5% level)	-2.918778	-2.92378	-2.916566	-2.916566	-2.916566

Note: When p-value is higher than 0.05, the null hypothesis cannot be rejected, indicating the variable is not stationary. Test Equations include intercept.

The KPSS test takes the form of equation (3.3). From the results summarised in table 4.3b, the null hypothesis of stationarity was accepted at $\alpha = 0.05$ significance level at first differences. The results suggest that all series are stationary at$I(1)$). The results are as shown in table 4.3b below:

Table 4/KPSS Stationarity Test

	LOG	GOVINV	GOVREC	HPRICE	MORTLOAN	PCAPIN
Null Hypothesis: Series is stationary						
Level	test statistics	1.048547	1.017841	0.884583	0.881351	0.895974
	critical values	-0.739	-0.739	-0.739	-0.739	-0.739
1st Difference	test statistics	0.35113	0.187871	0.5	0.162396	0.087258
	critical values	-0.463000	-0.463000	-0.463000	-0.463000	-0.463000

Note: When LM-statistic is lower than critical-value at 0.05, the null hypothesis cannot be rejected, indicating the variable is stationary. Test Equations include intercept.

4.4.2 Lag Length Selection

VAR analysis depends critically on the lag order selection, since different lag orders can significantly affect the substantive interpretation of the estimates when those differences are large enough (Nyongesa, 2017). Mukras (2012) notes that one practical problem in the estimation of VAR models relates to the number of variables to be included in the model and the maximum lag length to be applied. The common strategy in empirical studies is to select the lag order by some pre-specified criterion and to condition on this estimate in constructing the VAR estimates (Nyongesa, 2017). Therefore, Table 4.4 below shows information criterion for the lags. From the table, LR, AIC and FPE suggest optimal lag length of 4 while SC and HQ show optimal lag length of 2.

Table 5VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LHPRICE LGOVINV LGOVREC LMORTLOAN LPCAPIN
Exogenous variables: C
Date: 02/20/19 Time: 13:54
Sample: 2004Q1 2017Q4
Included observations: 52

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10.77687	NA	1.26e-06	0.606803	0.794422	0.678732
1	210.7903	392.0035	6.61e-10	-6.953474	-5.827756*	-6.521900*
2	230.5182	31.10941	8.32e-10	-6.750701	-4.686886	-5.959483
3	272.7916	58.53242	4.59e-10	-7.415063	-4.413150	-6.264201
4	310.9158	45.45572*	3.19e-10*	-7.919838*	-3.979827	-6.409331

* 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: Hannan-Quinn information criterion

The selection of lags is more appropriate for lower lag values. In this study, a lag of 4 was selected using the AIC. The choice of (AIC) was because it is considered efficient (Brooks, 2008) over FPE.

4.4.3 Cointegration

After verifying that the series are *I(1)* and lag length selected, tests for cointegration was done to identify stable, long-run relationships between sets of variables.

4.4.3.1 Johansen's Cointegration Test

In this study, Johansen's test for cointegration was chosen because it avoids the issue of choosing a dependent variable as well as issues created when errors are carried from one step to the next (Johansen's, 1995). Johansen's trace test (table 4.5) showed that there is 1 cointegrating relationship at the p=0.05 significance level.

Table 6Johansen's Trace Test

Lags interval (in first differences): 1 to 4

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistics**	**0.05 Critical Value**	**Prob****
None*	0.431112	75.23616	69.81889	0.0173
At most 1	0.350631	46.46851	47.85613	0.0671

Trace test indicates 1 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

4.4.3.2 Cointegrating Equation (Long-run equation)

The long-run relationship established showed that there is a linear combination between the variables that forces them to move together, despite potential deviation from equilibrium

levels in the short-term. From table 4.6, a long run equation is derived with corresponding estimates of each variables used in this study as shown below.

Table 7Cointegrating Equation Coefficients

1 Cointegrating Equation (s)			Log likelihood 325.5242		
LHPRICE	**LGOVINV**	**LGOVREC**	**LMORTLOAN**	**LPCAPIN**	**CONSTANT (C)**
1.000000	-0.226185	-0.078526	-0.133144	-0.399524	0.821068
	(-0.03146)	(-0.03509)	(-0.03795)	(-0.52605)	
	[-7.189961]	[-2.23785]	[-3.50841]	[-0.75948]	
	{0.0250}	{0.0146}	{0.000}	{0.5168}	

Note: standard error ( ) t-statistics [ ] { } p-values & Lag length is 1-4

From the cointegrating coefficients above, we get the long run (normalized) equation as

The coefficient estimate was estimated by time series data in levels corresponding to equation 3.1. Therefore, the estimated long-run equation is as given below;

(4.2)

$$hprice = 0.821068 + 0.226185 govinv_{t-1} + 0.078526 govrec_{t-1} + 0.133144 mortloan_{t-1} + 0.399524 pcapin_{t-1}$$

The parameter estimates in equation 4.2 are all positive and conform to theory and previous empirical findings. These estimates also indicate positive effect of these variables on residential house prices in Kenya. A detailed discussion is provided in section 4.5 below;

4.5: Discussion and Interpretation of the Cointegration Results

This section discusses and interprets the long run effects of explanatory variables on residential house prices in Kenya

4.5.1 Effect of government expenditure on residential house price

Equation 4.2 showed that government investment and recurrent expenditures positively have a significant effect on residential house prices in Kenya. Specifically, results of this study demonstrate that a 1% increase in government investment expenditure in the previous period will cause a 0.23% increase in residential house prices in the current period; similarly a 1% increase in government recurrent expenditure in the previous period will cause a 0.08% increase in of house prices in the long-run.

These finding imply that, *ceteris paribus*, government expenditures on public goods such as roads, water and electricity provision usually causes the prices of residential houses to rise. Generally, the greater quantity and the higher quality of public goods in a region, the higher house prices; the prices of residential house in leafy suburb areas in cities like Nairobi, Mombasa and Kisumu are much higher than those in areas with less infrastructural development.

Growing house price is good news to house owners (often the older generation) but discouraging news to households out to purchase; this in return exasperates house affordability challenges. In addition, rising residential house prices shows that house buyers have to allocate a greater percentage of their earnings as deposits.

Comparing these results to those of previous studies, there are two issues observed. Firstly, in this study it is observed that at national level, public expenditure on investment has a bigger effect on residential house prices than spending on goods and services which is in line with the findings of Thai (2016). This finding contradict that of Garcia et al (2003) who found out that public expenditure on purchases of goods and services had a bigger effect on residential

house price than spending in real investment at city level in Barcelona, Spain . Plausible explanation for this is that, at national level, lager portion of investment expenditures goes to constructions of roads, electricity, water provisions and other infrastructures which are directly related to residential housing as opposed to expenditure at city level which largely focuses on recurrent expenditure.

Secondly, agreeing with the results of (Chiang et al (2012); Tai, (2016) & Li et al (2017)), this study confirmed the long-run positive effect of government investment expenditure and expenditure on goods on house prices. Reasonable explanation for this result is the capitalization effect-where public investment expenditure is absorbed in the residential house price; consequently, residential house prices rise.

4.5.2 Long-Run Effect of Mortgage Credit on Residential House Price

From the long-run equation above, mortgage credit results is positive and significant. Specifically, a 1% increase in mortgage credit will cause a 0.13% growth in residential house price. This finding implies that residential house financing in Kenya is still minimal.

Low mortgage values in a country implies that, *holding other factors constant,* outstanding mortgage values are lower that what they ought to be if mortgage loans were not limited to just a few. At the moment, mortgage credit is based on collateral meaning that residential house purchase is only available to households that can afford mortgage financing.

This study finding is corroborated by the findings of Brissimis and Vlassopoulos (2009) for Greece, Rodriguez-Fernandez & Qi, 2013 for China and Zu& Tang (2014) for UK who found out that mortgage credit is highly significant and has the expected positive sign. The elasticity

of residential house price with respect to mortgage debt in Kenya is much smaller at 0.13 than that of other countries such as Luxembourg 0.87 reported by Filipe (2017) and Norway 0.98 documented by Anundsen and Jansen (2013). In other words, house prices respond roughly seven times more strongly to changes in credit in developed countries than in developing economies, a finding similar to (Égert and Mihaljek, 2007).

The slow response of mortgage credit to house prices reflects a smaller dependence of residential house market on the mortgage loans in Kenya. This shows that majority of house purchase for consumption or investment is not financed through mortgage loans. This is true because the average mortgage loan in Kenya is Ksh. 8 million (USD=80,000) which is way above medium-to-low income earners accessibility.

4.6 Vector Auto regression Estimate

Short run effects of changes in explanatory variables on house prices and the influence of lagged residual on short run changes in residential house prices were evaluated using the vector error correction model. VECM is VAR which has been designed for use with non-stationary data having cointegration relationship (Enders, 2015). VECM was preferred in this study since it estimated the short term effect of explanatory variables on house prices. In addition, even though there was only one co-integrating relationship; VECM made it possible to estimate speed of adjustment coefficient.

4.6.1 Vector Error Correction Estimate (short-run)

To obtain a VECM, the VAR model 4.2 above was differenced as explained in sections 3.6.4.Table 4.8 presents the estimation output of the VECM short-term dynamics, with the elimination of statistically insignificant variables.

Table 8Vector Error Correction Model

	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.406613	0.19971	-2.036017	0.0436
D(LGOVREC(-4))	-0.039582	0.015436	-2.564219	0.0114
D(LPCAPIN(-4))	-1.238784	0.520641	-2.379343	0.0186
C	0.02789	0.013357	2.088092	0.0385

R-squared	0.639805
Adj. R-squared	0.378974
Sum sq. resids	0.049371
S.E. equation	0.041261
F-statistic	2.452952
Log likelihood	104.6095
Akaike AIC	-3.239588
Schwarz SC	-2.406251
Mean dependent	0.021027
S.D. dependent	0.052358

From table (4.7) above, short-run estimated equation corresponding to equation (3.7) is as follows;

$$\Delta lhprice = \mathbf{0.406613}ECT_{t-1} + \mathbf{0.039582}\Delta lgovrec_{t-4} + \mathbf{1.238784}\Delta lpcapin_{t-4} + \mathbf{0.027890} \quad \textbf{(4.3)}$$

4.7 Discussion and Interpretation of the Short-run Results

This section discusses and interprets the short run effects of explanatory variables on residential house prices in Kenya.

4.7.1 Short-run effect of government expenditure on residential house price in Kenya

From equation (4.3), government recurrent expenditure has a positive and significant effect on residential house prices in the short-run. Specifically, results of this study demonstrate that a 1% increase in government recurrent expenditure will cause a 0.04% increase in residential house prices with a lag of four periods. Price elasticity of house with respect to recurrent expenditure is half the value of the long run elasticity.

4.7.2 Short-run effect of per capita incomeon residential house price in Kenya

From equation (4.3), per-capita income has a positive and significant effect on residential house prices in the short-run. Specifically, results of this study demonstrate that a 1% increase in per-capita income in fourth quarter will cause a 1.24% increase in residential house prices in the current period.

4.7.3 Error Correction Estimate

The coefficient of the error correction term is 0.40 which is negative and statistically significant. In empirical sense, it implies 40% of the disturbance in the short run (deviation from the long run) is corrected each period. It is often of interest to estimate how long it will take for an existing disequilibrium to be reduced by 50% (half-life of disequilibrium). In this case, housing prices deviation from their long-run equilibrium will revert back to the fundamental value within approximately one and a half periods.

The short-term results above could be explained by deviation in house prices from their equilibrium occasioned by unique features of house market such as deposits, lags in supply, information asymmetry etc. Additionally, this study records that speed of adjustment in a

developing economy is higher compared to developed economies. This was established when comparing with by Égert and Mihaljek (2007), who also found a higher adjustment speed back to stable prices in the case of OECD countries.

4.8 Diagnostic Test and Model Checking

There are several assumptions about the unrestricted VAR models. Before embarking on discussion and interpretation of VECM results, it was important to test residuals of the model and see if the residuals obey the assumptions previously stated in section 3.7. In addition, it was paramount to check stability of the model estimated.

4.8.1 Normality test

In order to be sure whether the estimated parameters and their confidence interval estimates remain robust, a test of normality of residuals was carried out. The results were as follows;

Figure 4.1: Result of Normality Test of Residuals

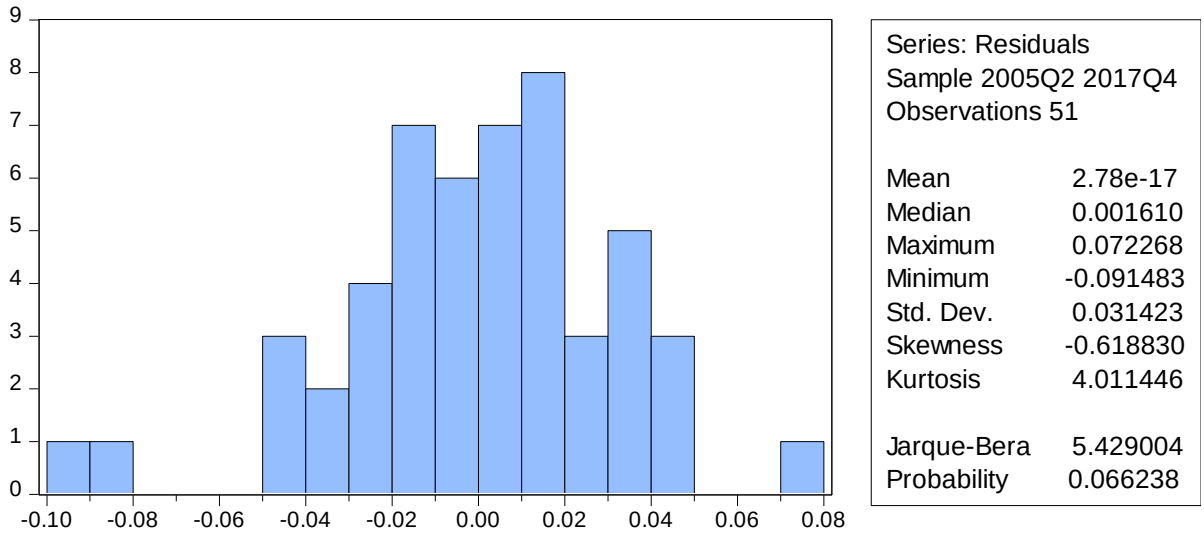

FIGURE 2/*Result Of Normality Test*

From figure 4.1, the study failed to reject the null hypothesis of normality because the p-value is more than the significance level. This implies that the residual were normally distributed. Moreover, the histogram is bell-shape implying that the residuals are normally distributed. Therefore, the model used in estimation is robust.

4.8.2 Serial Correlation Test

To ensure that the OLS estimates as efficient, a test for serial correlation was carried out and the results were as;

Table 9/Result of serial correlation test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 4 lags

F-statistic	0.457331	Prob. F(4,25)	0.7662
Obs*R-squared	3.477374	Prob. Chi-Square(4)	0.4813

Source: *Researcher, 2019*

The above results imply that the OLS estimates are efficient.

4.8.3 Heteroskedasticity test

Heteroskedasticity causes the OLS estimates to be less precise. In order to be sure that the coefficient estimates are not further from the correct population values, test results fir heteroskedasticity were as below;

Table 10/Results of heteroskedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.973200	Prob. F(25,25)	0.5268
Obs*R-squared	25.15366	Prob. Chi-Square(25)	0.4538
Scaled explained SS	12.24622	Prob. Chi-Square(25)	0.9845

According to the test result above, the study failed to reject the null hypothesis of homosckedasticity and concluded that the residual is constant across the plot and therefore coefficients of estimates are precise.

4.8.4 Stability diagnostics

Stability diagnostic was carried out to determine whether the model of the study was dynamically stable. Using recursive estimates (the CUSUM), the results revealed that the model of study is stable since the blue trend line lies within the red line boundary.

Figure 4.2: Result of Stability Diagnostic

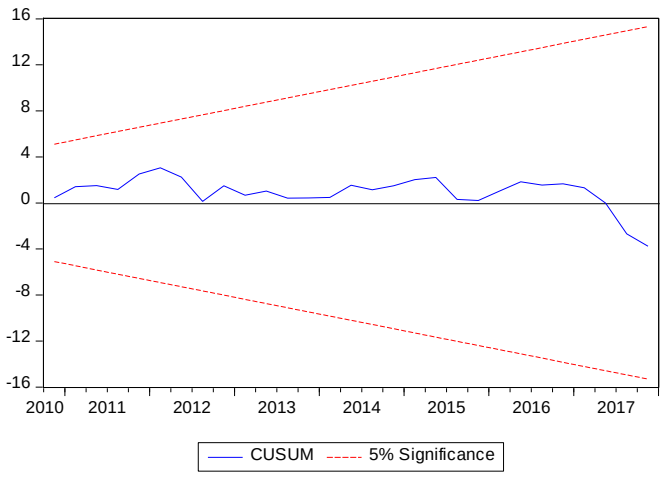

FIGURE 3/RESULT OF STABILITY DIAGNOSTIC

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter presents summary of the findings of the study. Secondly, based on the main findings, the study discusses these results for policy implications and finally, recommendations for further study are made.

5.2 Summary of Findings

This study examined the effect of government expenditure, mortgage credit and individual income on residential house prices between 2004Q1 to 2017Q4 employing Johansen cointegration and Vector error correction models. This study presents further empirical literature on the factors explaining the surge in house prices within a developing country.

From this study, it is appears that residential house prices in Kenya continue to surge and this growth has outpaced growth in per capita income. Moreover, the government expenditure remains on the upward trajectory while mortgage credit remains elusive for majority of urban Kenyans.

Concerning correlation between house prices and explanatory variables in this study, results revealed strong positive correlation between house prices and all explanatory variables. For instant, the correlation coefficient between house price and government investment expenditure was 0.603503 while for government recurrent expenditure, mortgage credit and per capita income, it was 0.608015, 0.954732 and 0.971973 respectively at 5% significance level.

In measuring the effects on explanatory variables, the results indicated that government investment and recurrent expenditures have statistically significant positive effect on residential house prices in the long run. The same result can be concluded for mortgage credit. On the other hand, per capita incomes have no statistically significant effect on house prices even though it had a positive coefficient estimate.

On the short-run effects, per capita income now plays a statistically significant positive role on house prices with a coefficient of 1.238784 at $p = 0.05$. In the same breadth, government recurrent expenditure too affects residential house prices in the short run.

Finally, the study findings indicated that the market adjusts any divergence towards long run stability state at a speed of 40%. This result confirms findings of previous studies of a faster speed of adjustment towards long-run equilibrium for developing countries.

5.3 Conclusion

Based on empirical results evidenced in this study, the following conclusions were drawn in respect to the variables of the study. This study concludes that government expenditures and mortgage credit explain the continuous rise in residential house prices. On the other hand, Per capita income in Kenya does not explain rising residential house prices.

Finally, this study concludes that any short- term deviation from long run equilibrium house price is corrected within one and a half quarters.

5.5 Recommendations

Government should focus on policies that increase house supply. One such policy is to target providing bulk infrastructure (water, sewage, and power, access roads) to attract the private sector to underdeveloped urban regions and low-income groups since this is an important measure to increase residential house supply which will ease pressure on residential house prices.

Central bank of Kenya together with mortgage institutions to develop mortgage products tailor made for middle and low income earners to create demand for increased residential house supply. In order to strengthen banks' balance sheets and prepare them better for possible shocks, regulators should promote more prudent risk management practices by banks. This can be done by setting lower loan-to-value ratios in the mortgage market.

5.6 Contribution of the Study

In addition to practical implications, this study also contributed to existing literature on house price factors.

5.6.1 Contribution to Economic Theory

Results of this study are invaluable to academicians and researchers alike. It contributed to the current understanding of price theory in economic literature given that it is one of the first empirical tests on determinates of house prices in Kenya. The results further confirm results of existing studies that emphasized the role of government expenditures. Given that Kenya is a developing country, features of the Kenyan economy were used to illustrate any differences in developing and developed economy. Moreover, this study contributed to macro econometric analysis of economic variables in Kenya.

5.6.2 Contribution to Practitioners

The short-run results inform those purchasing a house for investment to take advantage of price reduction since house prices revert back to equilibrium within a short period.

To policy makers, this study provides a better understanding of the drives of house prices in Kenya, which may assist policy makers develop responsive policies that are geared towards increasing residential house supply.

5.7 Suggestion for further study

A panel research is necessary for a better understanding of the variations in prices for different kinds of properties and of the differences between regional housing economies. In addition, similar study in a micro setup should be pursued further.

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APPENDIX 1: DATA IN MILLION KENYA SHILLINGS

	GOVINV	GOVREC	HPRICE	MORTLOAN	PCAPIN
2004Q1	57172.06	288523.13	9.80	19700	0.016774
2004Q2	86943.35	109476.42	9.90	20010	0.016409
2004Q3	14107.21	599024.11	9.60	19800	0.016404
2004Q4	36825.92	429039.62	9.70	20060	0.016641
2005Q1	70723.48	377511.84	10.30	19700	0.016769
2005Q2	106332.37	137122.56	10.30	23600	0.017093
2005Q3	25772.48	683781.61	10.80	23000	0.017120
2005Q4	59662.06	466251.61	10.80	24600	0.017146
2006Q1	102502.89	504815.53	10.60	27900	0.017132
2006Q2	157983.23	76033.17	11.20	25700	0.017633
2006Q3	22973.70	836463.54	11.80	23400	0.017915
2006Q4	73757.24	595485.04	12.05	24500	0.017888
2007Q1	130377.58	421408.06	12.46	34700	0.018125
2007Q2	204820.22	162207.58	12.84	25300	0.018355
2007Q3	31479.23	868611.36	12.55	26000	0.018478
2007Q4	125748.23	627562.98	12.91	24000	0.018407
2008Q1	194874.62	480894.50	12.79	23100	0.017547
2008Q2	291960.28	1163779.94	12.48	26900	0.018107
2008Q3	40424.64	2050523.75	15.09	29400	0.018140
2008Q4	137834.30	727422.48	15.97	33800	0.017747
2009Q1	218727.93	578658.35	16.62	39000	0.017831
2009Q2	378204.47	227876.58	14.14	43300	0.017932
2009Q3	69376.05	1177620.06	17.82	46400	0.018077
2009Q4	157707.82	816812.63	18.95	52800	0.018060
2010Q1	318428.83	672380.80	19.13	53800	0.018263
2010Q2	579983.20	243417.45	19.13	81700	0.018671
2010Q3	65861.33	1408995.58	19.50	93000	0.019256
2010Q4	221668.39	979921.74	20.29	98900	0.019589
2011Q1	382298.23	719301.46	20.80	104900	0.019663
2011Q2	555959.40	238133.20	20.89	118000	0.019508
2011Q3	63645.34	149113.17	21.47	104500	0.019528
2011Q4	241497.24	1044257.14	21.11	137400	0.019664
2012Q1	479121.03	898587.03	21.60	143400	0.019756
2012Q2	699188.49	310710.68	22.10	150700	0.019692
2012Q3	114008.35	1804520.13	23.88	158400	0.019872
2012Q4	298012.54	1262291.32	23.73	161900	0.020287
2013Q1	495452.99	936105.88	23.62	166100	0.020463
2013Q2	892065.16	357578.33	24.13	176600	0.020532
2013Q3	45054.03	2191490.61	24.29	181800	0.020639
2013Q4	251999.57	1491928.13	23.84	198300	0.020681
2014Q1	447144.29	1118699.19	24.05	213200	0.020834
2014Q2	432660.31	395383.80	24.80	225140	0.021103
2014Q3	46772.64	2242557.78	25.60	248100	0.021172
2014Q4	336492.12	1492762.65	26.20	262700	0.021303
2015Q1	773012.59	1344614.22	26.10	255000	0.021517
2015Q2	1287404.27	381441.11	26.70	268870	0.021636
2015Q3	75570.73	2846698.51	27.40	279200	0.021834
2015Q4	502755.69	1948660.53	28.70	282600	0.022023
2016Q1	757565.89	1530855.84	29.90	312400	0.022185
2016Q2	1163240.39	530292.51	31.10	323200	0.022343
2016Q3	87680.22	3348252.70	31.50	329600	0.022432
2016Q4	598087.48	2183264.47	31.40	337400	0.022559
2017Q1	1115492.37	1598935.75	31.40	351100	0.022728
2017Q2	1683670.51	492355.00	30.40	355700	0.022863
2017Q3	88895.76	3935631.28	29.80	358800	0.022893
2017Q4	478643.11	2614059.97	30.10	366500	0.023142

Source: *Researcher, 2019*