EFFECT OF MONEY MARKET FACTORS ON FORMAL HOUSING GROWTH IN KENYA

BY

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DECLARATION

Declaration by the Student

This Thesis is my original work and has not been presented for a degree in any other University or for any other award.

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Declaration by Supervisors

This Thesis has been submitted for examination with our approval as the University Supervisors.

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DEDICATION

This work is dedicated to my entire family, my wife Mariam and children Nicole and Nixon for their moral support and patience towards completion of this report.

ABSTRACT

With high formal housing shortages across the globe, money market factors such as interest rates have been found to influence formal housing development in advanced economic regions such as USA, South America and Europe. While annual demand for formal houses is estimated at 250,000 units and only 50,000 being provided, there exists an annual deficit of 200,000 units and several studies attempting to explain factors affecting formal housing growth have mainly focussed on spatial factors and overall macroeconomic variables such as Gross Domestic Product, rental income, public debt, money supply and unemployment yet formal housing deficit continue to widen. Thus, inadequate attention has been given to financial money market factors that include exchange rates, savings interest rates, investment interest rates and inflation rates which are critical to any investment. Hence this study sought to analyse the effect of money market factors on formal housing growth in Kenya. The specific objectives of the study were to; examine the effect of exchange rates on formal housing growth; establish the effect of savings interest rates on formal housing growth; examine the effect of investment interest rates on formal housing growth and finally establish the effect of inflation rates on formal housing growth in Kenya. This study was anchored on the Solow Neoclassical Growth theory which uses the Cobb-Douglas approach suitable to specify a housing growth function. This study adopted a correlation research design. A correlation analysis and regression were adopted respectively to necessitate the determination of association and effect. The study used a time series secondary data for the period 1970-2014; the period under which most post-independence housing policies in Kenya were implemented. Tests for Autocorrelation, multicollinearity, stationarity, heteroscedasticity and cointegration were undertaken. Data was sourced from annual economic surveys and analysed using Ordinary Least Squares approach at 5% level of significance. The study findings established that exchange rates and investment rates were significant with $(\beta_1 = -0.58676; p = 0.0411)$ and $(\beta_3 = -0.48436; p = 0.0248)$ respectively in influencing formal housing growth. A 1% increase in exchange rate in previous two years decreases current housing growth by 0.59% while a 1% increase in investment interest rates decreases housing growth by 0.48%. Inflation and savings interest rates were however insignificant. With an F-statistic of 3.618852 it was concluded that Money market factors were significant in influencing formal housing growth and accounted to 20.75% of formal housing growth variation. In order to boost formal housing growth in Kenya, the study recommends for strengthening of the Kenyan Shilling and lowering of investment interest rates. The study is useful to housing practitioners, government and investors in formal housing.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ADF	- Augmented Dickey Fuller
AR	- Autoregressive Model
BG	- Breusch Godfrey serial correlation test
CBK	– Central Bank of Kenya
DF	- Degrees of Freedom
EAC	- East African Community
GDP	– Gross Domestic Product
GoK	- Government of Kenya
OLS	- Ordinary Least Squares
UN	- United Nations
US	- United States of America
VECM	- Vector Error Correction Model
VIF	– Variance Inflation Factor

OPERATIONAL DEFINITION OF TERMS

Formal housing	- houses developed after undergoing approval from relevant regulatory authorities and their completion reported.
Housing	– buildings or other shelters in which people live; a place to live or a dwelling unit
Housing Growth	– increase in the number of formal residential houses developed in Kenya in a given year excluding extensions both for residential and non-residential.
Money market factors	- financial macroeconomic factors whose level of outcome is affected by money supply which include exchange rates, savings interest rates, investment interest rates and inflation rates.
Exchange rate	- This is the rate of exchange for one Kenya Shilling as quoted against the US dollar.
Investment interest rates	- annual average lending interest on loans for investment purposes.
Savings interest rates	- annual average interest on deposits
Cost of Housing Development	-total cost of the house including the construction cost, cost of the land and other incidental costs such as approvals plus a premium.

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Housing has a central importance to quality of life with considerable economic, social, cultural and personal significance. According to Sen (1999), housing is one of the largest expenditures that a family can make, and it is a superior good, in as much as the share of income spent on housing typically increases disproportionately as income rises. Adequate and decent housing provides several benefits; first, families live and spend a large amount of time in their houses. Houses are one of the few places that families can use for rest and relaxation. As such, housing quality contributes substantially to well-being, quality of life and mental health. A proper house can induce a sense of dignity and pride. According to Ireri (2010), housing plays a huge role in revitalizing economic growth in any country, with shelter being among key indicators of development. Erguden (2001) further noted that though a country's national prosperity is usually measured in economic terms, increasing wealth is of diminished value unless all can share its benefits and if the growing wealth is not used to redress growing social deficiencies, one of which is housing.

The 1948 United Nations Universal Declaration of Human Rights identified housing, along with food and clothing, as a basic requirement for achieving an adequate standard of living. Despite this, almost one billion people, primarily in the developing world, live in urban slums and lack proper housing (United Nations, 2003). Most slum dwellers live in informal houses characterized with dirty floors, poor-quality roofs, and walls constructed out of waste materials such as cardboard, tin and plastic. These houses do not provide proper protection against inclement weather, are not secure and are not pleasant to live in. Many have insufficient access to services such as clean water, sanitation and electricity (UN-Habitat, 2003 and Marx et al, 2013). It is therefore important that any given country should consider the welfare of its people by undertaking to provide adequate, decent and affordable housing to its citizens alongside the associated housing infrastructure.

In order to provide decent and quality houses, various countries have put in place institutions to handle approval and delivery of the houses. Such houses constitute what is called formal houses. However, despite the effort in place to provide adequate formal houses, many countries

in the world have been faced with the problem of providing adequate formal housing to their residents. The global assessment of informal housing according to (UN Habitat, 2010) show that 828 million or 33 per cent of the urban population resides in slums' informal houses. In the state of the world's cities 2012/2013, UN Habitat estimated the number of people living in the slums (where most of informal houses are found) of the world's developing regions as 863 million in contrast to 760 million in 2000 and 650 million in 1990. In Latin America and Caribbean region, a region where slum upgrading, and housing strategies have historically contributed to provide formal housing solutions to its citizens, still the problem of inadequate formal housing prevailed with a 24 per cent rate urban slum dwellers residing in informal houses (UN Habitat, 2013). The UN Habitat estimates showed that Brazil was faced with formal housing shortages of about 450,000 housing units in cities and urban areas largely contributed by high and extreme levels of poverty, high costs of land and high construction and house prices. The Brazilian government had particularly been tackling the causes of formal housing shortages by directly getting involved in providing housing, expanding housing finance, provision of housing infrastructure as well as adapting the housing supply and urban regulations to the income level of the population (UN Habitat, 2013). The Brazilian case of growth in formal housing could thus be stated to have depended on spatial and some macroeconomic factors particularly land, infrastructure and house prices but the deficit gap has continued to widen.

In Asia, according to State of the world cities report (2012/13), 30 per cent of the urban population resided in informal housing in slum areas yet the continent was home to half of the urban population of the world (UN Habitat, 2013). According to Ballesteros (2002) majority of households in Asia were unable to pay for the cost of housing and land. According to the study, access to formal housing in Asia was limited by high annual housing prices with about 32% of major cities being affected. Provision of formal housing in Europe, according to Scanlon & Whitehead (2007) was also characterised by deficits. In order to tackle the shortages, the European countries with exception of Hungary have been pursuing social housing policies by directly providing housing to their residents. Hungary on the other hand had been pursuing a fiscal strategy in formal housing development. The social housing policy had targeted different segments of their populations such as the very poor, low waged working families and the middle classes which is basically the income groups. Despite the social policy there had indeed remained a high demand than supply in European urban areas which according to Scanlon and Whitehead (2007) was contributed by high increasing prices which had made

entry into owner occupation difficult. However, it was difficult to state whether the shortages in housing in Kenya was contributed by increasing prices. While European countries are more developed and experience higher housing prices, Kenya was still low developed and unlike the European countries that pursue social policy for housing provision it rather focused on provision of infrastructure and promotion of public private partnerships.

In Africa, there continued to be a persistent deficit gap between formal housing supply and demand with over half of the urban population (61.7%) living in informal houses in slums (UN Habitat, 2013). The deficit gap in provision of formal housing in Africa has been contributed by high construction prices. Countries like Zambia showed that housing deficits were 13.5 million by the year 2010. Housing demand in the same year was on an average of 60,000 units per year. To boost development of more formal housing in order to bridge the gap, Zambia had for instance been forced to adopt strategies including addressing the rising cost of land, development of the housing finance sector, addressing prevailing high interest rates, provision of housing infrastructure, reducing cost of building materials through adoption of local low-cost materials and use of plot size standards through acceptance of smaller plots and minimum standards (UN Habitat, 2012). Kenya pursued near similar policies of housing like Zambia and similarly experienced high deficits of about 250,000 units per year. It was thus important that other factors such as exchange rates and inflation could be brought on board and their influence assessed to establish their contribution on formal housing growth.

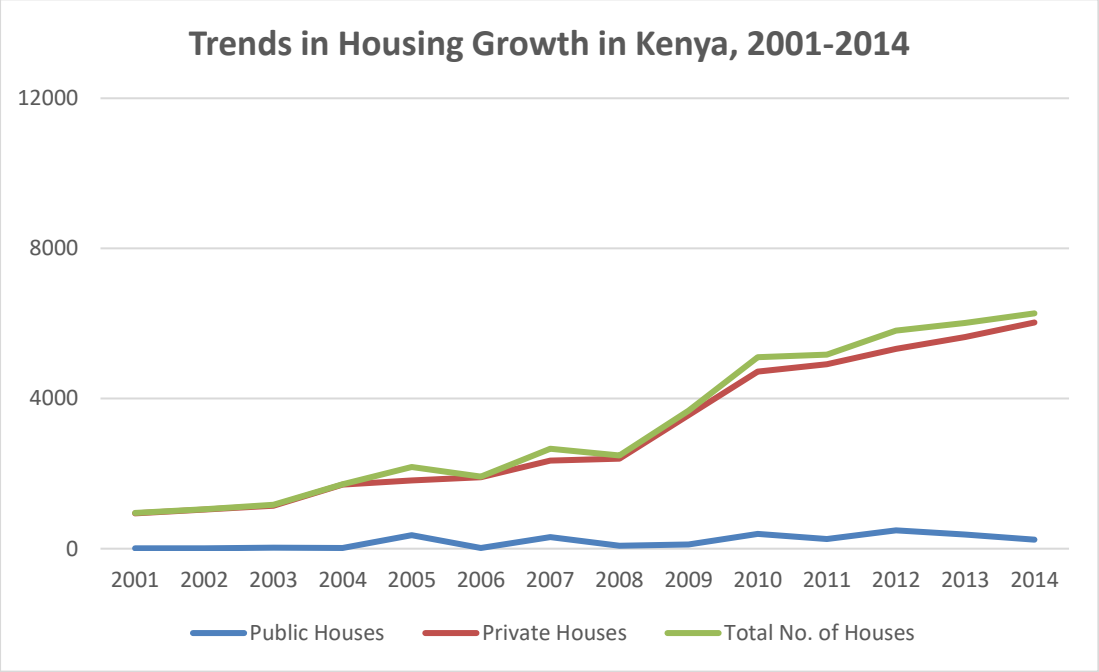
Based on the above findings, it could be said that formal housing shortage was a global problem that many countries were struggling to solve by use of a multiple of strategies such as social housing, lowering costs, provision of infrastructure and use of fiscal and monetary strategies. The financial money market sector was one critical area that most countries were also considering driving housing growth as established in different reports.

1.1.1 The Kenyan Formal Housing Market

The Kenyan formal housing market during the study period was such that there existed the problem of formal housing scarcity which could be traced back to the time of independence where the first post-independence housing policy, Housing Policy of 1966/1967 Sessional Paper No 5 was formulated. This policy advocated for greater budgetary vote for the government to provide affordable housing. The population at the time was about 9,948,000 as at 30th June 1967 (GoK, 1968). With the increased population of about 41 million in the year 2013 in need of formal housing, the Kenya government was still faced with inadequate and

indecent housing. The house prices have continued to be exorbitant with majority of the people falling below the poverty line. The government has since been in pursuit of providing adequate, decent and affordable housing to all by the year 2030 (GoK, 2008). The number of formal houses developed has been increasing but has not been able to match the demand. Trends in housing growth are as illustrated in the figure below;

Figure 1.1 Trends in Housing Growth in Kenya, 2001-2014



Source: Various Economic Surveys, 2003-2015

One of the latest attempts to address issues of formal housing shortages was the recognition of housing as a right in the Constitution of Kenya, 2010. The strategy to be used in providing the right was as spelt out in the National Housing Policy of 2004, a policy that targeted to bridge the existing deficit gap of over 150,000 units at the time. One way according to the policy was making housing affordable to the majority poor (low income earners) by addressing several housing inputs such as housing financing, provision of infrastructure, improvement of land tenure rights, eradication of poverty through slum upgrading and legislation (GoK, 2011). Despite this effort, the housing market in Kenya continued to experience a mismatch between demand and supply. The Kenya Housing Survey of 2012 later established that while the annual demand for housing was estimated to be 250,000 units, only 50,000 units were being developed. The annual development of residential units therefore continued to fall short of demand to an estimated deficit of 200,000 units by the year 2012 (GoK, 2012). This eventually

led to proliferation of slums and informal settlements characterised by various social ills and poor living standards. The housing market according to the National Housing Policy of 2004 was characterized by a number of weaknesses including low supply, financial and regulatory constraints. However, based on the level of supply, the housing policy could be said to have been ineffective in matching formal housing growth and demand since it has not been able to facilitate the delivery of the required number of formal houses over the years and above all the annual deficit has been widening from 150,000 units in 2004 to 200,000 units by 2012.

1.1.2 Money Market Factors

The study of the effects money market factors has on formal housing growth is very critical to any given economy. First, measuring the dynamic effects of money supply innovations on the housing market is important to understand whether or not monetary policy is neutral (Baffoe-Bonnie, 1998) and (Lastrapes, 2002). If housing growth does not respond to changes in money supply, then it can be said that money is neutral for the housing market. Second, monetary policy is known to affect many macroeconomic variables that may, in turn, influence the housing market (Lastrapes, 2002). The general view is that prices are an important determinant of housing market activity and, theoretically, an increase in money supply leads to a rise in prices, as the quantity theory of money proposes. Third, money supply affects housing investment through its effect on interest rates (Bernanke and Gertler, 1995) and thus opens a channel for monetary policy transmission through the credit market. Thus, monetary policy may not be neutral for the housing market due to a direct effect through interest rates and an indirect effect through prices and exchange rates.

According to Griffiths and Wall (2004), exchange rate fluctuations affect nearly all macroeconomic activities in the economy. The effect of exchange rate on formal housing growth can be traced to the monetary approach. According to the study findings, exchange rate in the money market is determined in turn by demand for and supply of money. When money supply increases, individuals would hold more money and excess holdings used to buy more goods from foreign countries hence creating a Balance of payment deficit and downward pressure of exchange rate. It was therefore conclusive that during the period in the economy when money supply is high, exchange rate would be low and expenditures high. It is therefore at this time that more formal houses could be developed since inputs imported can actually be obtained at lower prices. While low exchange rates have been advocated for by Griffiths and Wall (2004) to increase expenditures on economic activities, formal housing being one of the major economic activities, it is not clear if the exchange rates in Kenya over the years have had

any impact on Kenya's formal housing growth. Studies in Kenya such as Juma (2014) estimated the relationship between exchange rate fluctuation on real estate investment, but real estate is quite broad encompassing land, housing, space and infrasructure and therefore the question of the effect of exchange rate on formal housing growth in Kenya was not adequately adressed in the study.

Elmendorf (1996) on the other hand identified interest rate on savings as a factor in housing growth and development among other economic activities. The study finding established that personal saving is determined by interest rate on savings. The relationship was such that in the money market, a contractionay monetary policy rises interest rates on savings and this in turn increases personal saving hence reducing consumer spending in the economy. This in turn affected personal investments such as investment in formal housing. While the study by Elmendorf (1996) considered the effect of interest rate on savings, it considered it at an individual level yet saving schemes can help production of more formal houses by building and giving units to individuals out of the pooled resources. Therefore, while savings interest rates were identified by the Elmendorf study to negatively affect formal housing growth, it ignored the fact that higher savings interest rates can be used to attract savings geared towards future investment in formal housing. While Elmendorf study was done in the United States, there was inadequate evidence to show that a study had been done in Kenya that considered the effect of interest rates offered on savings and its influence on formal housing growth in Kenya.

Interest rates on investments have also been particularly identified as the most explanatory variable in housing growth in the US. Abraham and Hendershott (1992) established that macroeconomic factors including investment interest rates and employment were significant in influencing housing prices. The effect of interest rates on investment on house prices was supported by Iacoviello and Minetti (2003) which established that house prices in the United Kingdom became more sensitive to investment interest rate changes in the European countries. Sensitivity of house prices was discovered to intensify when interest rates on investment were relatively low in the recent past. Short term interest rates on investment, according to Adams and Fuss (2010) affected demand for housing due to the effect on mortgage rates and the cost of financing for construction firms in the United Kingdom. While the studies had considered the effect investment interest rates would have on formal housing, they majorly dwelt on the United States and the United Kingdom. A closer study in Kenya by Chesang (1991) considered the determinants of private investment in provision of urban housing, it did not consider the

effect of investment interest rates on formal housing growth but rather on income, construction costs, location and total housing stock. It was therefore clear that studies that considered the relationship between investment interest rates and formal housing growth were based in the United States but there was inadequate evidence that such a study had been done in Kenya.

Another factor believed to influence housing growth in the United States according to Lastrapes (2002) is Inflation. Inflation according to the study affect price-rent ratio which is a signal of a likely future downturn in the economy. While Adam and Fuss (2010) established that economic variables such as industrial production, level of unemployment and monetary supply significantly influenced demand for housing in the United Kingdom, Lastrapes (2002) showed that monetary policy was known to affect many macroeconomic variables that in turn influenced the housing market. The general view was that prices were an important determinant of housing growth and theoretically an increase in money supply also affected housing investment through its effect on inflation and interest rates (Bernanke and Gertler, 1995). This scenario was particularly noted in the US. In economic theory, increase in money supply is likely to lead to high inflation rates and this is likely to push individuals to cushion themselves by investing in economic activities where returns may be good such as housing. Therefore, formal housing growth was expected to be high during the period of high inflation. Studies in Kenya such as Mwania (2010) estimated demand for residential housing in Kenya and showed that prices greatly determined demand for housing. While demand in Kenya was estimated at 250,000 units per year, supply was only about 50,000 and the deficit gap has continued to widen. The study thus did not consider what ought to be done with the prices to boost formal housing growth in order to meet the demand it estimated. Studies to consider the effect of inflation on formal housing growth were however missing.

It could therefore be concluded that while available literature on formal housing provision in other countries (Abraham and Hendershott 1992; Iacoviello and Minetti 2003; Adams and Fuss 2010; Bonnie 1998 and Lastrapes 2002) had been carried out and showed that macroeconomic variables which affected formal housing growth were majorly money market factors, there was inadequate evidence to show that such studies had been done in Kenya. Literature review showed that studies in the Kenyan case had mainly focussed on spatial factors that affected housing supply and demand (Chesang 1991; Mwania 2010 and Wagura 2013). Mwania (2010) considered some of the money market factors but the study looked at the demand side of housing rather than growth. While other studies in Kenya had also focussed on overall macroeconomic determinants of housing supply (Juma 2014 and Kariuki 1993), inadequate

evidence existed that there was a study which had directly linked only money market factors to formal housing growth. Juma (2014) looked at the growth in the real sector which other than formal housing encompasses land and infrastructure. Kariuki (1993) on the other hand looked at the effect of cost of credit on housing supply but did not consider that cost of credit is an aggregation of investment interest rates, legal fees, insurance, government levies, stamp duty, valuation fees and security registration certificate fees. Various studies thus had mixed both spatial and macroeconomic variables as independent variables and hence a direct relationship between housing growth and money market factors could not be clearly drawn. The aggregation of variables by Juma (2014) and Kariuki (1993) could also not provide individual effects of money market factors on formal housing growth. This study therefore intended to fill this gap by looking particularly at how money market factors identified by Handa (2009) and Piotrowska (2013) as Exchange rates, Interest rates on savings, interest rates on investments and Inflation rates affected formal housing growth in Kenya. The number of formal houses developed in this case were the ultimate output determined by a given set of inputs which could clearly be explained by a Cobb-Douglas production function which assumes that the output, number of formal houses developed was being influenced by a set of inputs in this case the money market factors aforementioned.

1.2 Statement of the Problem

With the annual demand requirement of 250,000 formal housing units and only 50,000 being provided, there existed an annual deficit of 200,000 units. Despite the Kenyan government efforts to help reduce the gap mainly through legislation and policy formulations, the gap seemed to be widening rather than declining. Studies done in the area of formal housing provision mainly dwelt on spatial factors such as planning and availability of land. Other studies looked at the general macroeconomic factors such as Gross Domestic Product and per capita income. However, these studies alongside their policy recommendations had not been able to offer a solution to the problem of housing shortage. On the other hand, the money market plays a significant role on any aspect of economic development and hence factors directly affected by money supply such as exchange rate, inflation, savings interest rates and investment interest rates can play a significant role on housing growth being a major economic activity. However, there is inadequate evidence that a study has been done in Kenya to establish how the money market factors in particular affect formal housing growth. It was therefore important to do this study to explain how money market factors affected formal housing growth in Kenya.

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of this study was to investigate the effect of money market factors on formal housing growth in Kenya.

1.3.2 Specific Objectives

i. To examine the effect of exchange rates on formal housing growth in Kenya.
ii. To establish the effect of savings interest rates on formal housing growth in Kenya.
iii. To examine the effect of investment Interest rates on formal housing growth in Kenya.
iv. To establish the effect of inflation rates on formal housing growth in Kenya.

1.4 Research Hypotheses

1. H_0 : Exchange rates have no effect on formal housing growth in Kenya.

   H_1 : Exchange rates have an effect on formal housing growth in Kenya
2. H_0 : Savings interest rates have no influence on formal housing growth in Kenya.

   H_1 : Savings interest rates have an influence on formal housing growth in Kenya.
3. H_0 : Investment interest rates have no effect on formal housing growth in Kenya.

   H_1 : Investment interest rates have an effect on formal housing growth in Kenya.
4. H_0 : Inflation rates have no influence on formal housing growth in Kenya.

   H_1 : Inflation rates have an influence on formal housing growth in Kenya.

1.5 Justification of the Study

There has been great concern about the shortages being experienced in the number of houses produced in the country. This study was thus of much interest to policy makers in the housing sector particularly in the Department of Housing and Urban Development in increasing awareness on the effect money market factors had in helping reduce the widening gap of formal housing shortages. They can be able to know how different money market factors influenced formal housing growth and hence incorporate them into housing policies during their formulation.

This study also forms an empirical foundation of formal housing growth in an endeavour to provide adequate housing for all. Being an academic study, it adds to the limited literature on the effect of money market factors on formal housing growth and hence can be used by future

researchers in studies related to the housing sector and its relationship with other macroeconomic variables in order to provide adequate formal housing in Kenya.

Private investors can also benefit from this study as they can be able to know how various money market factors can influence their investment decisions. In this respect, they can access credit for housing when it is worthy. They can also be able to know when to import building materials and continue to be profitable.

This study can also be significant to financial institutions and individuals. Many financial institutions encourage their clients to save with them with an ultimate aim of accessing funds for housing development. However, the choice of saving with an institution would greatly be dependent on interest rates offered for savings. This study can thus help both the financial institutions and investors on how to attract and retain individual investors as well as how the investors will make decision to save for housing. Most investors obtain funds for housing through credit. However, financing through credit can greatly be affected by the prevailing lending interest rates. This study is thus important to investors in making decisions as pertains credit for housing development. Banks can also utilise findings in this study in attracting customers.

1.6 Scope of the Study

The focus of this study was limited to establishing the effect of money market factors on formal housing growth in Kenya for a 45-year period from 1970-2014. This period was selected because the first housing policy for Kenya after independence having been formulated in the 1966/1967 financial year and advocated for increased budgets for housing, the increased allocation was only realised in the 1968/1969 financial year (from K£ 818,000 to K£2,130,000) budget with budgetary effects expected to be observed in the 1969/1970 financial year as the production of a house would take some time to be fully completed. The scope of formal houses in this study was limited to the number of new residential buildings and excluded extensions. All residential houses whose development underwent approval from the relevant authorities in Kenya and their completion reported were considered as formal houses for the purpose of this study.

1.7 Theoretical Framework

This study was anchored on the neoclassical Solow growth theory developed by a Harvard economist, Professor Robert Solow in 1956. The neoclassical Solow growth theory was built on and used a Cobb Douglas production function to specify the relationship between a given output to a given set of inputs in the form;

$$Q_t = A_t K_t^{\alpha} L_t^{\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1.1$$

Where Q_t is the aggregate output (in this case number of houses developed); A_t is technical factor productivity at time t (positive constant); L_t is labour at time t; K_t is other physical capital of the country at time t; (α) and (β) are positive fractions.

According to Chiang (1984), some of the major features of this function are:

i. It is homogeneous of degree $(\alpha + \beta)$;

ii. In the special case of $(\alpha + \beta = 1)$, it is linearly homogenous;

iii. Its isoquants are negatively sloped throughout and strictly convex for positive values of K and L; and

iv. It is strictly quasiconcave for positive K and L

This theory was relevant in this study since it was understood from 1920s to be an explanation of the determinants of the value of output (Biddle, 2012). Production of housing requires both labour and capital. Technology, A is critical in ensuring efficient delivery of housing units. According to Chiang (1984) equation (1.1) could thus be modified in a case of more than two variables and hence in terms of the Cobb-Douglas function the restricted model for housing growth was expressed as;

$$HP_t = A_t EXR_t^{\beta_1} INTS_t^{\beta_2} INTI_t^{\beta_3} INF_t^{\beta_4} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1.2$$

Where HP_t - Number of houses developed

EXR_t - Exchange rate at time t;

$INTS_t$ - Interest rate on savings at time, t;

$INTI_t$ - Interest rate on investments at time, t;

INF_t - Inflation rate at time, t.

A_t - Constant/Level of technology

$\beta_{1,2,3,4}$ - Responsiveness of housing growth to changes in money market factors

However, while money market factors may affect formal housing growth, they may not be the only factors since previous studies had shown that other socio-economic factors such as GDP per capita (Juma, 2014), population growth and employment levels (Abraham and Hendershott, 1992) had significantly affected investment in other economic activities housing included. These variables were thus considered as intervening variables in this study. Cost of housing development was also found critical in housing growth (Adams and Fuss, 2010) and hence was also considered as a control variable. The expanded formal housing growth model in Cobb-Douglas form involving control variables was thus of the form;

$$HP_t = A_t EXR_t^{\beta_1} INTS_t^{\beta_2} INTI_t^{\beta_3} INF_t^{\beta_4} GDPC_t^{\beta_5} POP_t^{\beta_6} EMP_t^{\beta_7} CHP_t^{\beta_8} \text{.....} \text{.....} 1.3$$

Where $GDPC_t$ - Gross Domestic Product per capita at time, t

POP_t - Population growth rate at time, t

EMP_t - Employment level at time, t

CHP_t - Cost of housing development

$\beta_{1,2,3,4,5,6,7,8}$ - Responsiveness of housing growth to changes in money market factors

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examined previous studies that related to housing growth. It highlighted what had been done on related issues; lessons learnt and identified critical gaps that existed in various empirical studies. The section is divided into four major sub-sections. The first sub-section examines an overview of money market in an economy. The second sub-section examines a study of theories put forward that explain housing growth in an economy. The third sub-section reviews studies conducted by various researchers in the field of housing growth. The fourth sub-section critically reviews works that have been done by various researchers. The fifth sub-section identifies gaps in the literature that will be filled by this study.

2.2 Theoretical Literature

The Solow neoclassical growth theory has been used to explain housing growth and production and therefore has been covered in this study as follows;

2.2.1 Solow Neoclassical Growth Theory

This basic neoclassical growth theory was developed by Robert W. Solow in 1956. Solow stressed the importance of savings and capital formation for economic development, and for empirical measures of sources of growth. Solow postulates a continuous production function linking output to the inputs of capital and labour which are substitutable.

Solow used the following Cobb-Douglas production function to distinguish among the sources of growth-labor quantity and quality, capital, and technology;

$$Q_t = A_t K_t^{\alpha} L_t^{\beta} \quad \text{.....2.1}$$

Where Q_t is output, A_t the level of technology (is a non-negative scale or efficiency parameter), K_t capital, and L_t labour. A_t is neutral in that it raises output from a given combination of capital and labor without affecting their relative marginal products. The parameter and exponent α is $[(\Delta Q/Q)/(\Delta K/K)]$, the elasticity (responsiveness) of output with respect to capital (holding labor constant). (The symbol Δ means increment in, so that $\Delta Q/Q$ is the rate of growth of output and $\Delta K/K$ the rate of growth of capital.) The parameter β is

$(\Delta Q/Q)/(\Delta L/L)$, the elasticity of output with respect to labor (holding capital constant). Assuming that $\alpha + \beta = 1$, then this represents constant returns to scale (that is, a 1 percent increase in both capital and labor increases output by 1 percent, no matter what present output is), and perfect competition, so that production factors are paid their marginal products, then α also equals capital's share and β labour's share of total income. (Constant returns to scale, where output and all factors of production vary by the same proportion, still entail diminishing returns, where increments in output fall with each successive change in one variable factor). According to Solow, the Cobb–Douglas production function allows capital and labor to grow at different rates.

The neoclassical model predicts that incomes per capita between rich and poor countries will converge. But empirical economists cannot find values for parameters and variables (such as α, β, and capital formation rates) that are consistent with neoclassical Equation 2.1 and the evidence of lack of convergence. Without modification or augmentation, the Solow model is thus a poor predictor.

The model is thus modified to accommodate money market factors and housing growth. Capital is a function of investment which in turn is a function of interest rates and income. Interest rates in housing growth can be considered in terms of investment interest rates and savings interest rates. The capital variable in the model was thus substituted with investment interest rates and savings interest rates as money market factors and GDP per capita as a control variable. Labour was substituted with inflation and exchange rate. Both inflation and exchange rates were believed to influence income levels hence provision of labour. Upon substitution, the econometric model in the form of the Cobb-Douglas was thus;

$$HP_t = A_t EXR_t^{\beta_1} INTS_t^{\beta_2} INTI_t^{\beta_3} INF_t^{\beta_4} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{...} 2.2$$

Where HP_t - Number of houses developed

EXR_t - Exchange rate at time t;

$INTS_t$ - Interest rate on savings at time, t;

$INTI_t$ - Interest rate on investments at time, t;

INF_t - Inflation rate at time, t.

A_t - Constant/non-negative scale/efficiency parameter

$\beta_{1,2,3,4}$ - Responsiveness of housing growth to changes in money market factors

This theory was therefore relevant in this study since it could be used to specify inputs in the production process against outputs. It provided the relationship between output and a given set of inputs. This study was thus anchored on this theory where it utilized the Cobb-Douglas production function and modified the Solow equation to adapt it to the study of the effect of money market factors on formal housing growth in Kenya.

However, the use of this theory has its own limitations. While the model is based on the assumption of labour-augmenting technical progress, it is a special case of the Harrod-neutral technical progress of the Cobb-Douglas production function type which does not possess any empirical justification (Jhingan, 1999). Solow also left out the causative of technical progress and treated the latter as an exogenous factor in the growth process. He thus ignored the problems of inducing technical progress through the process of learning, investment and capital accumulation.

2.3 Empirical Literature

2.3.1 Exchange Rates and formal Housing Growth

A study by Xiaoling (2007) sought to analyse housing prices in China and possible policies using monthly time series secondary data from 2003 to 2006. The study identified the causes of high housing prices as merchandise value and currency value. According to the study, currency itself value (exchange rate) was one of the critical factors affecting price and supply of housing in China. The main finding was that the exchange rate was highly undervalued which attracted a lot of international capital and hot money to rush into the chinese real estate sector to invest or speculate hence increasing demand for housing. This was partly because of an anticipation of exchange rate appreciations. The study established that during undervaluation, most foreign companies and individuals bought more than five sets of houses (13%) and later transferred them (20%) which made speculation more and more obvious since in international real estate investment, exchange rate fluctuation dramatically affect investor's profits. This argument was found consistent with the argument by McConnel and Brue (1998) which showed that changes in relative interest rates between two countries can alter their exchange rate. A rise in real interest rate in one country makes it more attractive for financial investments who will pursue that particular country's currency for exchange. However, in the

study of Xiaoling (2007) the finding that undervaluation attracted foreign investors who purchased more than one set of houses, it is clear that the study focused on the demand side of housing. The finding that investors purchased more than one set of houses did not consider a fact that most countries were faced with housing deficits particularly in developing countries like Kenya whose shilling has continually weakened over time, yet the expected investment in housing according to Xiaoling (2007) had no indication of reducing formal housing deficit gap.

Juma (2014) on the other hand established the effect of macroeconomic variables on growth in the real estate investment in Kenya. Using annual time series secondary data of exchange rate fluctuations, growth in diaspora remittances, growth in money supply, inflation and GDP growth, the study established that there was a strong positive relationship of the variables with real estate investment growth. The study however noted that exchange rate, diaspora remittances, money in circulation, inflation rate and real GDP growth did not individually influence growth in real estate growth. The study used data for the variables between 2000-2013 and established that all the macroeconomic variables used in that study had been declining over the time period. The study considered exchange rate as one specific determinant of real estate growth which majorly influences housing growth. While the study considered some of the money market factors, the dependent variable (real estate growth) was more general as it covered land, housing and infrastructure. It could therefore not be clearly established from the study if the variables as used could influence formal housing growth, formal housing scarcity being one of the major problems that faced the country. Also, the time period considered in the study did not hold a conclusive investigation period because it was too short to determine a long run relationship. This could have partly contributed to the study finding that the variables did not individually influence growth in the real estate. Also the money in circulation is a significant determinant of the exchange rate in an economy and thus the use of both variables was likely to have posed a problem of multicollinearity which the study did not consider. This study thus directly considered the effect of money market factors on formal housing growth and over a longer period considered sufficient enough to determine a long run relationship.

2.3.2 Interest rates on Savings and formal Housing Growth

Elmendorf (1996) survey study sought to establish the effect of interest rate changes on household saving and consumption in the United States. The study observed that the response of savings to changes in interest rates was central to many issues in economics. According to the study, a reduction in the budget deficit caused interest rates to decline. This triggered a reduction in the personal saving hence a reduction in the national saving. This scenario

according to the finding increased expenditures to economic activities where returns were good. One particular economic activity identified in the study was housing provision. On the contrary, the study established that in cases of a contractionary monetary policy, there was a rise in saving interest rate hence personal saving also increased. This led to a corresponding fall in consumer spending hence slowing down economic activities. The study was summarised by recommending that measures to lower saving interest rate were good in order to enhance economic activities. The scenario in Kenya however, was that interest rates on savings had remained relatively low for many years yet rate of housing growth had likewise remained low with annual deficit gaps widening so much. While Elmendorf (1996) study showed that lower interest rates on savings ultimately led to increase in formal housing in the US, there had been inadequate focus over the same in Kenya. There was thus need for this study to establish the effect interest rates had on formal housing growth in Kenya. This is from the finding that studies in Kenya had not paid attention to the relationship between savings interest rates and formal housing growth in Kenya.

Malhar (2011) also established a relationship between targets, interest rates and household saving in urban China. It was established that one particular determinant of household saving was the interest rate and that this was largely ignored by other researchers. In order to increase economic activities, the study advocated for measures that would induce households to save less and spend more if the economy was to be rebalanced. One particular measure identified in the study was the interest rate liberalization and a change in saving deposit rates. This according to the study was to influence saving and investment decisions. According to the study, household savings responded strongly to a change in interest rate and that whenever real rate of return on bank deposits increased, household saving rate dropped and this affected economic activities. This finding just like Elmendorf (1996) did not link persistent low interest saving rates to formal housing growth in developing countries where the deficit had been widening. The studies suggested that saving interest rates should be kept low in order to increase the rate of economic activities. Kenya on the other hand has had low savings interest rates yet the deficit gap had been widening. The finding by Malhar (2011) that low rates increased formal housing in China could thus be inapplicable in Kenya. Kenyan studies had however largely ignored finding out the effect savings interest rates had on formal housing growth.

2.3.3 Interest rates on Investment and formal Housing growth

Interest rates on investment according to Hyman (1994) referred to the rate of the price for the use of funds usually expressed as a percentage per shilling of funds borrowed for investment. Samuelson (1970) defined interest as 'that percentage return per year which has to be paid on any safe loan of money which had to be yielded by any safe bond or other type of security and which had to be earned on the value of any capital asset in any competitive market where there were no risks or where all risk factors had already been taken care of by special premium payments to protect against risk'. In Kenya, the base lending rates were set by CBK which is the custodian of all commercial banks in Kenya. These rates are important in affecting access to capital needed for economic activities such as formal housing growth. This study thus intended to establish how the interest rates on investments affected housing growth.

Theodore and Panagiotis (2015) did a study on the macroeconomic determinants of the housing market in Greece using a VECM approach. The study looked at the interdependence between the housing price index and macroeconomic determinants including retail sector, Consumer price index, mortgage loans and taxes. According to the study findings, the retail sector and mortgage loans emerged in the longrun as the most important variables for housing. Mortigage loans in particular had the most explanatory power (29%) for the variation of housing price index. Mortgage loans were particularly affected by the prevailing interest rates in the market. When the rates were high, few mortgage loans were taken. Therefore, the interest rates played a critical role in assessing housing growth in any given market through their influence on housing financing. Unlike the Theodore and Panagiotis (2015) study based in Greece, studies in Kenya had not focussed on the effect of money market factors and particularly investment interest rates in this case on formal housing growth. Secondly, the study considered that investment interest rates affected formal housing as a secondary factor, that is, through mortgages. However, the consideration of mortgage loans as a factor could thus not give a direct effect investment interest rates had on formal housing since the relationship examined was mortgage loans and housing market.

A study by Kariuki (1993) sought to establish the real factors affecting the level of supply for houses in the Kenyan housing market. Supply for housing was defined by Syagga (1994) as real estate development which according to the study was similar to any other industrial or manufacturing process where a particular commodity could be produced in response to a given demand. Using primary data, the study established among others the main factors affecting the supply for housing and gave them as availability and cost of credit together with return on

housing investment. When cost of credit is low, more houses would be supplied and vice versa. The study concluded that measures be put in place to lower the cost of credit and this would boost housing production. However, the finding by Kariuki (1993) that cost of credit and return on housing investment as the main factors affecting development of housing and subsequent recommendation that lowering interest rates and raising return on housing investment is not specific. The cost of credit is a broad definition and encompasses investment interest rates, legal fees, insurance, government levies, stamp duty, valuation fees and security registration certificate. In the study therefore, the recommendation that lowering interest rates to influence formal housing production based on responses for cost of credit was thus not realistic. The analysis of the study data was also based on perception of respondents hence not exhaustive as trends in interest rates were not considered. This study therefore considered the effect investment interest rates have on formal housing growth based on the time series analysis.

Adala (1978) did a study on the housing market in Nairobi and established that the greatest barrier to new residential construction is the availability of credit finance at levels that can significantly alter the stock of housing and at prices that will promote the kind and form of long term investment required in housing development. The study established that improved access to mortgage facilities by low income segment in the economy be enhanced in order to increase the supply of low income housing. According to the study findings, housing finance, insurance, pension schemes, and commercial banks can play a big role in delivery of housing stock. The finding by Adala (1978) that availability of credit finance to levels that could alter the stock of houses was not exhaustive. The study established that there existed financiers of housing development but ignored the fact that the prevailing investment interest rates could hinder that access if too high. Subsequent studies in Kenya have also failed to directly relate investment interest rates to formal housing growth.

Adams (2008) did a study on macroeconomic determinants of international housing markets. Using a panel Cointegration analysis of 15 countries over a period of 30 years the study established two effects which is likely to have a major impact on the housing development schedule of new construction as a change in the short-term interest rates and construction costs. The study noted that higher short-term factors that increase the costs of construction such as an increase in the price of construction materials or stricter building regulations increase the financing costs of construction. Accordingly, both interest rates and costs of construction positively affect international housing markets and therefore should form a critical component of macroeconomic variables affecting international housing markets. While the study looked

at a scope of 15 countries, economic conditions for each individual country differs. Secondly, while Interest rates were found to influence the international housing markets, the study did not give country specific influence of investment interest rates on formal housing growth. This study therefore sought to consider this effect with particular consideration for Kenya.

Chesang (1991) did a study to establish the determinants of private investment in provision of urban housing in Kenya. The study involved collecting and analysing time series data on income, construction costs, credit allocated to housing, total housing stock and gross investment to estimate the industry investment function. The findings were that housing investors in Kenya highly responded to income changes, credit and construction costs. The study recommended policies that could boost investment in housing including the state allowing supply and demand to determine rent rates, the public sector to provide housing services to low income earners while the private sector left to cater for the high-income earners. It finally advocated for more allocation of funds to the housing sector. Based on this study, gross investment included the number of houses developed. Normally in economics, Gross investment is given as a function of interest rates. The study therefore failed to consider estimating the role of interest rate (a critical factor of the money market) on investment in housing in addition to income and construction costs, the variables it considered. The study also dwelt on provision of urban housing in Kenya and ignored the fact that while formal housing may majorly be an urban problem, it also affected rural areas of Kenya which ought to be considered together.

2.3.4 Inflation and formal Housing growth

Inflation is used to refer to a persistent rise in the general prices for goods and factors of production. Because of changes in relative prices and in total spending, the process of inflation causes definite and characteristic changes in the distribution of income among classes as well as in total output if the system had previously been well below its full employment potential (Samuelson, 1980). According to Hyman (1994), the price level is an indicator of how high or low prices are in a certain year compared to average prices in a certain base period. This is measured by the price index which is usually set at 100 in the base year or period. Inflation will usually occur when prices on average are increasing over the year.

There are two types of inflation; cost push inflation and demand-pull inflation. The effect of inflation on output depends on whether the initial impulse is cost push or demand pull. The cost push impulse leads to a rise in the price level and a drop-in output. Cost push inflation has

its impetus on the supply side of an economy. It results from an upward shift of the supply curve of an economy. Demand pull impulse on the other hand would shift the demand up resulting in a rise in the price level but also in increase in output. This is inflation when price increase is generated by an upward shift in the economy's demand (Branson, 1989). Thus, based on the Branson supposition, inflation can be used in the study of housing especially in this case on the input side. Cost push inflation can have a significant effect on the cost of materials needed for formal housing growth and ultimately its output. Inflation in an economy is greatly affected by the quantity of money in circulation and its control is usually mainly controlled by domestic borrowing. This study thus adopted inflation as one of its independent variables in determination of housing growth.

Traditional theory says relative prices of consumer goods and of such real estates such as land should not be permanently affected by rate of inflation. Feldstein (1980) established the relationship between Inflation and housing markets and prices in Malaysia and concluded that the price of inputs such as land had substantially increased even more than the inflation rate. The study was done using the time series data of inflation rates, tax rates, and land prices. The study showed that there was a positive relationship between inflation rate and housing prices hence should be considered in policies regarding housing supply. According to the study findings, inflation affected housing growth via the impact of input prices whereby when inflation was high, prices were also high and housing growth low. This study was commended by Piazzesi and Scheineider (2009) study which while studying momentum traders in the housing market in the US using multiple regression analysis established that higher expected inflation tends to lead to an increase in house prices with a reduction in housing growth. Based on these findings by Feldstein (1980) and subsequently by Piazzesi and Scheineider (2009), inflation had a positive relationship with housing prices in Malaysia and the US respectively. The studies established that inflation policies in Malaysia and the US needed to be persued to encourage accelarated growth in housing production in the two countries. However, the findings were inconsistent with what happens in other parts of the world particularly Kenya where interest rates have consistently remained high yet the problem of housing deficits continued to widen annually. In considering this however, there was inadequate evidence to show that studies had been done to link inflation and formal housing growth and thus it was difficult to establish how inflation rates influenced formal housing growth and whether the finding in Malaysia and US could be applicable to Kenya.

Mwania (2010) estimated the demand for residential housing in Kenya based on annual time series data for the period 1980-2009. The study used a log-linear demand equation to model the effect of housing prices, income per capita, average lending rate, prices of other related goods and inflation on number of housing units purchased. The results showed that income per capita was the most significant (at 95% level of significance) variable in explaining the demand for housing in Kenya both in the short-run and in the long-run. Additionally, the study found that the prices of other non-housing goods have a negative impact on the demand for housing. The study therefore recommended increase in per capita income in order to increase uptake of modern housing units. However, the finding was not sufficient because due to the existing annual housing shortages of about 200,000 units, very many people would demand to own houses but not everybody would access. While demand in Kenya was estimated at 250,000 units per year, supply was about 50,000 and the deficit gap continued to widen over the years. The study thus did not consider what ought to be done with the prices to boost formal housing growth in order to meet the estimated demand. Studies to look into the effect of inflation on formal housing growth were therefore missing.

2.4 Summary

The various studies in the literature review have shown that both spatial and macroeconomic factors affect development of housing in an economy. However, with the persisting problem of housing deficit, the policies recommended in the studies have been found to be inadequate in the delivery of formal housing as the gap has continued to widen. This calls for increasing the scope of knowledge on what other factors not previously covered in Kenya affect formal housing growth. One important area is the study on the effect of money market factors as they have been found significant in studies done in other countries, but little evidence exists to show that such a study has been done in Kenya. Xiaoling (2007) established that merchandise value and currency value affect housing growth in China. Elmendorf (1996) and Malhar (2011) also showed that household saving, interest rates, consumption and output targets influence housing growth in China. Theodore and Panangiotis (2015) on the other hand has shown that consumer price index, taxes and mortgage loans affect housing growth in Greece while Adams (2008) established that short-term interest rates and construction cost is what influences housing development in European countries. In Malaysia, Feldstein (1980) observed that Inflation, tax rates and land prices influence housing growth and this was supported by Piazessi and Scheineider (2009) for housing in the United States. Kenyan studies such as Chesang (1991) and Adala (1978) have on the other hand been concerned with spatial factors such as

construction costs as well as considering a few urban centres in Kenya. Kenyan studies that have focussed on money market factors such as Mwania (2010) have only looked at the demand side of housing but not growth. Another Kenyan study by Juma (2014) on the other hand considered some of the money market factors but the dependent variable (real estate growth) was more general as it covers land, housing and infrastructure and hence the effect of those money market variables could not be clearly established. It is therefore clear that while studies in other countries have looked at how money market factors influence housing growth, there is little evidence of such a study being done in Kenya. It was thus the intention of this study to fill this gap.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter covered methods and procedures that were used in conducting the study. It entails the design, applicable theories, model specification, measurement, econometric tests and data collection and analysis procedures.

3.2 Research Design

Research design is the conceptual structure within which research is conducted. It consists of the blue print for the collection, measurement and analysis of data. As such the design includes an outline of the framework of study, availability of various data and observations. It means the exact nature of the research work in a systematic manner (Kothari, 2003).

This study adopted a correlation research design, which according to Kothari (2004), can be used when the researcher wants to establish the relationship between two or more variables. This study involved establishing the relationship between formal housing growth and money market factors: exchange rate, interest rates on savings, interest rate on investment and inflation hence the appropriateness of the correlational research design.

3.3 Study Area

This study covered formal housing growth in Kenya. Kenya is a country in Africa and a founding member of the East African Community (EAC). Its capital and largest city is Nairobi. Kenya is located on the equator with the Indian Ocean lying to the south-east and is bordered by Tanzania to the south, Uganda to the west, South Sudan to the north-west, Ethiopia to the north and Somalia to the north-east. Kenya covers 581,309 km^2 (224,445 sq. mi), and had a population of approximately 45 million people in July 2014 as per the 2009 Population and Housing census projections (GoK, 2009). Some of the major urban areas where challenges of housing inadequacy have been experienced include Nairobi, Mombasa, Kisumu, Nakuru, Kilifi, Malindi, Eldoret and Kitale. Kenya as a country was selected because the problem of housing deficits has been largely pronounced, no known study has linked money market factors to formal housing growth in Kenya like in other countries and also several measures including studies and policies have been done to try and correct the problem, yet the deficit has continued to widen. While annual demand for housing by the year 2004 was estimated to be about 200,000

units with a supply of 30,000 units, the demand and supply have continued to gradually rise to an estimated 250,000 units and 50,000 units respectively. Housing data has also been recorded and sufficiently covers the entire country and study period.

3.4 Target Population

Target Population is the specific collection of elements that are studied (Neuman, 2014). The target population of this study consisted all post-independence houses developed in Kenya. Data analysed for this study constituted new formal houses developed in Kenya annually from 1970 to 2014. This period was selected because the first housing policy for Kenya after independence having been formulated in the 1966/1967 financial year and advocating for increased budgets for housing growth, the increased allocation was only realised in the 1968/1969 financial year (from K£ 818,000 to K£2,130,000) budget with budgetary effects expected to be observed in the 1969/1970 financial year as the development of a house would take some time to be fully completed (GoK, 1970).

3.5 Model Specification and Estimation

From Solow model (equation 1.2), the housing growth function was expressed as a Cobb-Douglas production function of the form;

$$HP_t = A_t EXR_t^{\beta_1} INTS_t^{\beta_2} INTI_t^{\beta_3} INF_t^{\beta_4} e^{\varepsilon_t} \ldots\ldots\ldots\ldots\ldots\ldots 3.1$$

Where HP_t - Number of houses developed at time, t;

EXR_t - Exchange rate at time, t;

$INTS_t$ - Interest rate on savings at time, t;

$INTI_t$ - Interest rate on investments at time, t;

INF_t - Inflation at time, t.

A_t - Constant/autonomous growth in housing

e^{ε_t} - error term

The multiplicative model (3.1) was taken and transformed it into a linear equation (3.2). A similar technique was used by Glaeser et al (2008) and Wagura (2013). The transformation of

the model using natural logarithms according to Chiang (1984) had proved vastly more convenient to use in analytical work than common logarithms. The logarithmic transformation in the production model was essential since according to Benoit (2011), there existed a non-linear relationship between independent and dependent variables in its form. The transformed equation was obtained as;

$$\ln HP_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INTS_t + \beta_3 \ln INTI_t + \beta_4 \ln INF_t + \varepsilon_t \ldots\ldots\ldots\ldots 3.2$$

Where $\beta_{i(i=1,2,3,4)}$ -Measures the responsiveness of housing growth to changes in money market factors.

β_0 -Autonomous housing growth

ε_t - Disturbance/error term [$\varepsilon_t \sim N(0, \delta^2)$] and $[\varepsilon_t = \varepsilon_t \ln e]$

The control variables established as other variables influencing housing growth in the empirical literature were added to equation 3.2 during the estimation and their effect on housing growth observed. This provided equation 3.3 which was examined as the second model for housing growth as;

$$\ln HP_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INTS_t + \beta_3 \ln INTI_t + \beta_4 \ln INF_t + \beta_5 \ln GDPC_t + \beta_6 \ln POP_t + \beta_7 \ln EMP_t + \beta_8 \ln CHP_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots 3.3$$

Where $\beta_{i(i=1,2,3,4,5,6,7,8)}$ - Measures the elasticities of housing growth to changes in explanatory variables.

ε_t - Disturbance/error term [$\varepsilon_t \sim N(0, \delta^2)$]

However, production of a formal house was expected to take time with most of them taking over one year to full completion. Hence the present dependence of formal housing growth was most certainly likely to depend on factors in the previous period(s). Due to lack of instantaneous dependence, Gujarati (2004) advocated for the use of time lags since they were found to be central in the study of econometrics. He suggested that for the psychological, technological and institutional reasons, lags could be used in order to take into account the delayed impact. In determining the number of lags and the variables to be lagged, this study used the Akaike Information Criterion (AIC) which is premised on the fact that the lower the value of AIC, the better the model. The AIC was considered because of its less harsher penalty for adding regressors to the model than the alternative Schwarz Information Criterion (SIC).

According to capital market theory proposed by Sharpe (1964), interest rates on investment were expected to have a negative relationship on the number of houses produced given that increasing interest rates increase the cost of borrowing discouraged investors or other people to take loans for real estate development. Interest rates on savings on the other hand was expected to have a positive relationship since they were likely to increase one's income that could be used to facilitate housing growth. Inflation on the other hand was expected to have a negative sign because as general price levels increased the purchasing power generally reduced hence reduction of disposable income which could otherwise have been used for development of housing. Exchange rate was expected to have a positive effect since appreciation of the currency was likely to attract investors who may engage in housing growth. The extraneous variables (GDP per capita and population) were expected to positively influence housing growth in the economy while negatively for employment levels and cost of housing development.

3.6 Measurement of Variables

This section describes the data used in housing growth regressions and are defined in table 3.1 below;

Table 3.1 Measurement of Variables

Variable	Type	Measurement	Source of Data	Hypothesized Direction (Expected a priori sign)
HP – number of houses developed	Dependent	Number of new residential buildings in a year.	Yearly economic surveys	None
EXR – Exchange rate	Independent	Annual average exchange rate of Kshs/US dollar	Yearly economic surveys	Positive
INTS – Savings interest rates	Independent	Annual average interest on deposits measured as a ratio of the product of principal, rate and time to 100%	Yearly economic surveys	Positive
INTI – Investment interest rates	Independent	Annual average lending interest on loans for investments measured as a ratio of the product of principal, rate and time to 100%.	Yearly economic surveys	Negative
INF – inflation rates	Independent	Ratio of average annual change in CPI in a year to the CPI of the previous year.	Yearly economic surveys	Negative
GDPC – Gross Domestic Product per capita	Extraneous	Annual average per capita figures	Yearly economic surveys	Positive
POP – population growth rate	Extraneous	Annual percentage change in population	Yearly economic surveys	Positive
EMP – employment level	Extraneous	Number of people in employment in each year	Yearly economic surveys	Negative
CHP - cost of housing development	Extraneous	Average value of a completed house	Yearly economic surveys	Negative

Source: Self-conceptualised

3.7 Data Collection Procedures and Sources

This study involved collection of secondary time series data. Secondary data according to Kombo and Tromp (2006) involves gathering data that has already been collected before. It involves collection and analysis of published material and information from internal sources. The secondary time series data covered a period of 45 years (1970-2014) collected on annual basis. Data on the variables was obtained from various yearly economic surveys obtained from Kenya National Bureau of Statistics and recorded in a Data sheet. Authority for conducting the study was obtained from the School of Graduate studies of Maseno University.

3.8 Data Analysis and Presentation

3.8.1 Analysis Techniques

The Data analysis technique used in this study was the Ordinary Least Squares technique. Descriptive statistics were used to describe the study findings while inferential statistics (correlation and regression) was used for the statistical analysis of data. Tests of significance were carried out on the parameter estimates including F-tests, probabilities, standard errors and subsequently determine acceptance or rejection of null and alternative hypotheses. The hypothesis was tested at 95% confidence level.

3.8.2 Diagnostic Tests

Secondary data being an external data is in its nature likely to lack validity and reliability and hence there was need to run various tests of significance. To ensure validity and reliability in this study, diagnostic tests were carried out on the coefficients of independent variables. This included test for multicollinearity, serial correlation and normality. The significance of the P-value and t-statistic at 95% level of confidence were also computed.

3.8.2.1 Test for Stationarity

The data was checked to establish whether it was stationary or not before conducting any econometric study. According to Granger and Newbold (1974), if the variables under study are non-stationary then they may lead to unauthentic results so it's important that the series of data is stationary. To determine whether the series had intercept and/or trend, graphs for each of the series were examined and established that each series exhibited both intercept and trend and hence the appropriate ADF test equation considered in testing unit root was as shown below;

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.4)$$

Where - ε_t is a white noise error term.

- t is the time/trend variable.

- m - is the maximum length of the lagged dependent variable which is determined empirically

The hypotheses in testing Unit root were;

$H_0 : \delta = 0$ There is a unit root

$H_1 : \delta < 1$ Time series is stationery

The rule of taking decision was that if the calculated value, t*> ADF critical value, then we do not reject the null hypothesis, i.e., unit root existed. If calculated value, t*< ADF critical value, then we could reject the null hypothesis, i.e., unit root did not exist. Non-stationary variables obtained were then differenced to make them stationary.

3.8.2.2 Cointegration Test

Cointegration was tested using an Engle and Granger two step technique as proposed by Russell and Mackinnon (1999). The following long-run model was estimated by ordinary least squares and its residuals obtained;

$$LNHP_t = \beta_0 + \beta_1 LNEXR_t + \beta_2 LNINTS_t + \beta_3 LNINTI_t + \beta_4 LNINF_t + \mu_t \ldots\ldots\ldots\ldots\ldots (3.5)$$

Where HP - Number of houses built at time, t;

EXR - Exchange rate at time t;

$INTS$ - Interest rate on savings at time, t;

$INTI$ - Interest rate on investments at time, t;

INF - Inflation at time, t.

Where $\beta_{i(i=1,2,3,4)}$ -Measures the responsiveness of housing growth to changes in money market factors.

β_0 -Autonomous housing growth

Equation (3.5) above included all the money market factors and since they were all of the same order of cointegration, they were thus considered cointegrated of order (1). The equation was regressed and forecast value for housing growth obtained, followed by the residuals. The

residuals were then tested for stationarity using the Augmented Dickey-Fuller (ADF) method. Since the variables were found to be cointegrated, the relationship between housing growth and exchange rates, investment interest rates, savings interest rates and inflation rates was expressed as an ECM;

$$DLNHP_t = \beta_0 + \beta_1 DLNEXR_t + \beta_2 DLNINTS_t + \beta_3 DLNINTI_t + \beta_4 DLNINF_t + \beta_5 \mu_{t-1} + \nu_t \ldots\ldots\ldots\ldots\ldots\ldots (3.6)$$

Where D – first difference operator

μ_{t-1} - lagged value of the error correction term from the residuals (ECM)

ν_t - white noise error term

Equation 3.6 gives the immediate/short-run impact of the changes in exchange rates, savings interest rates, investment interest rates and inflation rates on housing growth.

The ADF test was used to test the hypotheses;

H_0 : Residuals have unit roots

H_1 : Residuals have no unit roots

3.8.2.3 Test for Autocorrelation

This study employed the Breusch-Godfrey Serial Correlation (LM) test that was proposed by Breusch (1978) and Godfrey (1978) to test the null hypothesis of no serial correlation. This test was done to detect whether the error terms relating to any two different observations were mutually independent. Under the BG test, the following model was estimated by OLS and residuals obtained;

$$\ln HP_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INTS_t + \beta_3 \ln INTI_t + \beta_4 \ln INF_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (3.7)$$

Where HP_t - Number of houses developed at time, t;

EXR_t - Exchange rate at time, t;

$INTS_t$ - Interest rate on savings at time, t;

$INTI_t$ - Interest rate on investments at time, t;

INF_t - Inflation at time, t.

ε_t - Disturbance/error term

The residuals were then regressed on the regressors in model (3.7) above and autoregressive terms as follows and then R^2 obtained

$$RESID = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INTS_t + \beta_3 \ln INTI_t + \beta_4 \ln INF_t + RESID(-1) + v_t \ldots\ldots (3.8)$$

Where RESID and RESID (-1) were residual and lagged residual respectively.

The one lag length for the residual was chosen because of use of annual data (Gujarat, 2011). The F-value obtained from the regression was used to test the null hypothesis of no serial correlation against the alternative of presence of serial correlation.

The test for serial correlation was important in ensuring that the disturbance term of the data collected for Housing growth in Kenya from 1970 to 2014 occurring at one period of time did not carry over to another period.

3.8.2.4 Test for Multicollinearity

Multicollinearity is a problem that arises if some or all of the explanatory variables are highly correlated with one another. If multicollinearity is present, the regression model has difficulty telling which explanatory variables are influencing the dependent variables (Koop, 2013). The degree of Multicollinearity was measured by estimation of Variance Inflation Factors (VIF) defined as follows;

$$VIF(b_i) = \frac{1}{1 - R_i^2} \ldots\ldots (3.9)$$

where R_i^2 is the squared multiple-correlation coefficient.

The auxiliary regressions were run for each of the regressors and the R_i^2 obtained for the of the regressions and used to calculate the VIFs. The generated VIFs were checked to ascertain if they pointed to the presence of multicollinearity. The criteria used was that when $VIF \geq 10$, then there was considered to be a serious problem of multicollinearity hence need to be corrected through differencing or dropping some of the collinear variables (Gujarati, 2004).

3.8.2.5 Test for Heteroscedasticity

Heteroscedasticity is a serious problem which destroys the efficiency of OLS estimators. The Breusch-Pagan test proposed by Breusch and Pagan (1979) was used to test the presence of heteroscedasticity. Under the B-P test, the following regression model was estimated and squared residuals $(RESID\hat{}2)$ obtained;

$$\ln HP_t = \beta_0 + \beta_1 \ln EXR_t + \beta_2 \ln INTS_t + \beta_3 \ln INTI_t + \beta_4 \ln INF_t + \varepsilon_t \ldots\ldots (3.10)$$

Where HP_t - Number of houses developed at time, t;

EXR_t - Exchange rate at time, t;

$INTS_t$ - Interest rate on savings at time, t;

$INTI_t$ - Interest rate on investments at time, t;

INF_t - Inflation at time, t.

ε_t - Disturbance/error term

The squared residuals $(RESID\hat{}2)$ were then regressed on the regressors from the model as follows;

$$RESID^2 = \beta_0 + \beta_1 EXR_t + \beta_2 INTS_t + \beta_3 INTI_t + \beta_4 INF_t + v_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.11)$$

Where $RESID^2$ was the squared residuals

v_t is the error term

The above equation was important in establishing if the squared residuals were related to any one of the money market factors.

Test for heteroscedasticity involved testing the following hypotheses;

$H_0 : Var(u/x) = \delta^2 -$ there's homoscedasticity

$H_0 : Var(u/x) \neq \delta^2 -$ there's heteroskedasticity

The F test was examined for the joint significance of all the included independent variables. The Breusch-Pagan test required that to reject the null hypothesis, there needed to be obtained a Probability Value (or p-value) less than 0.05.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter provides detailed empirical analysis of the variables under study such as descriptive statistics, unit roots tests, cointegration tests and, long-run modelling to enable capture the actual effect of money market factors on formal housing growth in Kenya. Results are generated in this section, significance examined, and hypotheses tested.

4.1 Descriptive statistics

Descriptive statistics were computed to summarize the basic characteristics of the data series on money market factors and housing growth and hence form the basis for quantitative data analysis. The mean, maximum, minimum and standard deviation of the data gave the researcher a good idea of how good the data was. If there is little variability in the data, then the estimation process becomes a challenge because no variance can be explained and thus the research collapses. The Mean was used to locate the centre of the frequency distribution. The standard deviation gives the spread or dispersion in a series. The summary of the descriptive statistics for the variables used in this study are presented in Table 4.1.

Table 4.1 Descriptive Statistics of the Variables

	HP	**EXR**	**INTS**	**INTI**	**INF**	**GDPC**	**POP**	**EMP**	**CHP**
Mean	3023.089	42.33009	0.069309	0.178653	0.117133	23815.61	0.031842	1427398.	5.98E+09
Maximum	7022.000	87.92000	0.225000	0.720000	0.460000	124710.0	0.038230	2370200.	5.12E+10
Minimum	952.0000	6.900000	0.009600	0.080000	0.016000	678.4000	0.025800	644500.0	98200000
Std. Dev.	1656.607	31.24343	0.053389	0.109218	0.081419	29217.52	0.004832	464447.4	1.36E+10
Observations	45	45	45	45	45	45	45	45	45

Source: Own computation, 2016

The data used for analysis comprised 45 observations for each variable on annual basis from 1970 to 2014. The averages for the number of houses developed were found to be 3023.089 units. This indicates that the typical number of formal houses completed annually was 3023 units over the 45-year period. The lowest recorded number of formal houses developed was

952 in 2001 while the highest recorded figure was 7022 in 1979. This indicates that over the 45 years, the most number of formal houses were provided in 1979. The standard deviation of formal housing was found to be 1656.607. The large standard deviation indicates that growth in formal housing was widely spread from the average.

The exchange rates for the study period were found to have a mean of 42.33009 Kshs/US dollar. This indicates that over the 45-year period, the Kenya shilling was typically exchanged at the rate of Kshs. 42.33 against one US dollar annually. The lowest recorded exchange rate was 6.9 Kshs/US dollar in 1973 while the highest was 87.92 Kshs/US dollar in 2014. This indicates that the Kenya shilling was most stronger in 1973 and has since depreciated down to 2014. The deviation from the mean was found to be 31.24343 Kshs/US dollar. The small standard deviation indicates that exchange rates were narrowly spread from the average.

The average Savings interest rates for the study period was 6.93% ranging from 0.96% in 2013 to 22.5% in 1993. This indicates that over the 45-year period, the typical interest rates offered to savings annually was 6.93%. The deviation of the savings interest rates from the mean was 5.34%. The small standard deviation indicates that savings interest rates were narrowly spread from the average. The range of between 0.96% in 2013 and 22.5% in 1993 indicates that the rates offered to savings was highest in 1993 but it should be noted that this was the period when the economy suffered from depression, high prices and printed a lot of money. There was also liberalization at that time. This explains why the average was merely 6.93%, closer to the minimum of 0.96% than the maximum of 22.5%.

The average investment interest rates were 17.87%. This indicates that over the 45-year period, the typical interest rates charged on investment loans annually was 17.87%. With the highest rate of 72% recorded in 1993 and the lowest rate of 8% recorded in 1974 and 1975, the statistics showed that investment interest rates were highest in 1993 when the government experienced depression, high prices and a lot of money in circulation as well as liberalization at the time. However, the lowest recorded in 1974 and 1975 was also as a result of interest control measures. The deviation from the mean of the investment interest rates was 10.92% and the small standard deviation indicates that investment interest rates were narrowly spread from the average.

In terms of inflation, the average was 11.71%. This indicates that inflation rates over the 45-year period were typically 11.71% annually. The highest rate of inflation was 46% recorded in 1993 while the lowest was 1.6% recorded in 1995. The indication is that high prices

experienced in 1993 drove inflation to the highest level in that year before easing to the lowest in 1995 through monetary interventions. The standard deviation of 8.1% is a small dispersion and hence indicates that inflation rates over the study period were narrowly spread from the average.

GDP per capita had an average of Kshs. 23,815.61. this indicates that GDP per capita over the 45-year period was Kshs. 23,815.61 annually. The highest GDP per capita was Kshs. 124,710 recorded in 2014 while the lowest recorded was Kshs.678.4 in 1980. The statistics indicate that GDP per capita over the 45-year period contributed most to formal housing growth in 2014 while the least in 1980. It also indicates that GDP per capita in Kenya over the study period was highest in the year 2014. The standard deviation of Kshs. 29217.52 was a large dispersion which indicates that GDP per capita was widely spread from the average.

The mean for population growth rate was found to be 3.18%. This indicates that on average the population in Kenya over the 45 years period was 3.18%. The highest rate was 3.823% observed in 1982 and the lowest observed being 2.58% recorded in 1999. The deviation was however very small given as 0.4832% which indicates that the spread in population was very close to the average. The statistics indicate that population growth could have motivated formal housing growth most in 1982 and least in 1999.

In terms of employment levels, the average number of persons who got employed was 1,427,000. This implies that 1,427,000 people were employed annually over the 45-year period with the highest observed being 2,370,000 recorded in 2014 and the lowest being 644,000 people observed in 1970. The range between the highest and lowest recorded employment levels indicates that the number of persons employed peaked in 2014 hence increasing their income that could be used for formal housing provision. The standard deviation of 464,447.4 is a large dispersion hence indicating that employment levels were widely spread from the average.

In terms of the cost of housing development, the average value for completed houses per year was Kshs. 5,983,596(‘000) ranging from Kshs. 98,200(‘000) observed in 1970 to Kshs. 51,191,300(‘000) observed in 2014. This indicates that the value of formal houses completed was highest in 2014 despite the number completed not being the highest in that year which could signal increasing cost of construction. The standard deviation was also large indicating the cost of housing development was widely spread from the average.

4.2 Diagnostic Tests

4.2.1 Stationarity Test Results

The study used the Augmented Dick-Fuller test (ADF) for unit root tests and the results shown in table below 4.2 below obtained;

Table 4.2 Unit Root Tests

	At Level		**At First Difference**		**Order of Integration**
Variables	**t-statistic**	**Critical values 1% 5%**	**t-statistic**	**Critical values 1% 5%**	
HP	-0.096090	-4.205004 -3.526609	-3.665982	-4.205004 -3.526609	I (1)
EXR	-2.770141	-4.180911 -3.515523	-9.649492	-4.186481 -3.518090	I (1)
INTS	-1.885184	-4.180911 -3.515523	-8.731207	-4.186481 -3.518090	I (1)
INTI	-1.920022	-4.186481 -3.518090	-10.36785	-4.186481 -3.518090	I (1)
INF	-3.652401	-4.180911 -3.515523	-6.387784	-4.192337 -3.520787	I (1)
GDPC	-4.180911	-4.180911 -3.515523	1.424194	-4.198503 -3.523623	-
POP	-2.675070	-4.198503 -3.523623	-1.837419	-4.198503 -3.523623	-
EMP	-0.880902	-4.186481 -3.518090	-4.156954	-4.186481 -3.518090	-
CHP	-1.226633	-4.219126 -3.533083	3.262554	-4.219126 -3.198312	-
	At second Difference		**At third Difference**		
Variables	**t-statistic**	**Critical values 1% 5%**	**t-statistic**	**Critical values 1% 5%**	
GDPC	-6.639477	-4.198503 -3.523623	-		I (2)
POP	-4.643527	-4.198503 -3.523623	-		I (2)
EMP	-10.72229	-4.192337 -3.520787	-		I (2)
CHP	-2.790375	-4.234972 -3.540328	-6.820492	-4.219126 -3.533083	I (3)

Source: Own computation, 2016

From table 4.2 above, it is evident that all the variables were not stationary at levels. However, HP, EXR, INTS, INTI and INF became stationary after first differencing. Extraneous variables including GDPC, POP and EMP became stationary at second differencing while CHP at third differencing.

4.2.2 Test for Multicollinearity

4.2.2.1 Correlation Analysis

This analysis presents the degree of association (covariance) between two or more variables. A correlation matrix of the transformed series at levels was generated and yielded the results shown in the Table 4.3 below;

Table 4.3 Correlation Matrix at Levels

Covariance Analysis: Ordinary
Date: 17/06/17 Time: 11:53
Sample: 1970 2014
Included observations: 45

Correlation t-Statistic Probability	LNHP	LNEXR	LNINTS	LNINTI	LNINF	LNGDPC	LNPOP	LNEMP	LNCHP
LNHP	1.000000								

LNEXR	-0.414023	1.000000							
	-2.982564	-----							
	0.0047	-----							
LNINTS	-0.300530	-0.334000	1.000000						
	-2.066220	-2.323621	-----						
	0.0449	0.0249	-----						
LNINTI	-0.527872	0.618810	0.454631	1.000000					
	-4.075582	5.165625	3.347127	-----					
	0.0002	0.0000	0.0017	-----					
LNINF	0.090153	-0.132082	0.273520	0.166179	1.000000				
	0.593591	-0.873772	1.864700	1.105073	-----				
	0.5559	0.3871	0.0691	0.2753	-----				
LNGDPC	-0.253056	0.965716	-0.446805	0.476535	-0.134670	1.000000			
	-1.715227	24.39366	-3.274975	3.554377	-0.891209	-----			
	0.0935	0.0000	0.0021	0.0009	0.3778	-----			
LNPOP	0.374068	-0.937913	0.494703	-0.453357	0.291712	-0.902014	1.000000		
	2.644946	-17.73080	3.732741	-3.335317	1.999867	-13.70122	-----		
	0.0114	0.0000	0.0006	0.0018	0.0519	0.0000	-----		
LNEMP	-0.269359	0.953489	-0.326784	0.555278	-0.061191	0.973534	-0.852579	1.000000	
	-1.834091	20.74271	-2.267343	4.378211	-0.402008	27.93300	-10.69796	-----	
	0.0736	0.0000	0.0285	0.0001	0.6897	0.0000	0.0000	-----	
LNCHP	0.246850	0.750633	-0.532206	0.276149	-0.067602	0.848913	-0.693173	0.844022	1.000000
	1.670400	7.449810	-4.122196	1.884096	-0.444310	10.53238	-6.306362	10.31986	-----
	0.1021	0.0000	0.0002	0.0663	0.6590	0.0000	0.0000	0.0000	-----

Source: Own computation, 2016

The results show a positive and significant correlation between housing growth and population growth; GDP per capita and exchange rates; exchange rates and employment levels; exchange rates and investment interest rates; exchange rate and cost of housing development; investment interest rates and employment levels; GDP per capita and employment levels; GDP per capita and cost of housing development; as well as employment levels and cost of housing development. The positive sign means that when one of the paired variables is high, the other one would also be high and the two move in the same direction. The p-values for the above

positive paired correlations depicts a significant positive correlation since their p-values were less than 0.05. On the other hand, the correlation of the positive paired correlations between housing growth and inflation rates; housing growth and cost of housing construction; savings interest rates and inflation; inflation and investment interest rates and investment interest rates and cost of housing development did not exist since their associated p-values exceeded the p-value of 0.05.

However, there was a significant negative correlation between housing growth and exchange rate; housing growth and savings interest rates; housing growth and investment interest rates; exchange rates and savings interest rates; exchange rates and population growth; savings interest rates and GDP per capita; savings interest rates and employment levels; savings interest rates and cost of housing development; investment interest rates and population growth; inflation and population growth; GDP per capita and population growth; population growth and employment levels and population growth and cost of housing development. The p-values for the paired negative correlation was found to be below 0.05. The negative means that when one of the paired variables was high, the other one would be low. There however existed no relationship between housing growth and GDP per capita; housing growth and employment levels; exchange rates and inflation rates; inflation rates and GDP per capita; inflation rates and employment levels and inflation rates and cost of housing development at 5% level of significance.

4.2.2.2 Variance Inflation Factors

Due to the significant correlation observed between some of the paired variables, Variance Inflation Factors (VIF) were generated from the differenced transformed logarithmic variables as shown in Table 4.4 below;

Table 4.4 Variance Inflation Factors

Variance Inflation Factors
Sample: 1970 2014
Included observations: 42

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.002851	1.373715	NA
DLNEXR	0.266545	3.301295	2.842433
DLNINTS	0.031855	1.589182	1.585645
DLNINTI	0.130005	3.361123	3.349392
DLNINF	0.003520	1.062259	1.062230
D2LNGDPC	0.009067	1.139064	1.138864
D2LNEMP	4.133150	1.212766	1.212319
D2LNPOP	57.43569	1.071455	1.060516
D3LNCHP	0.002619	1.089644	1.089592

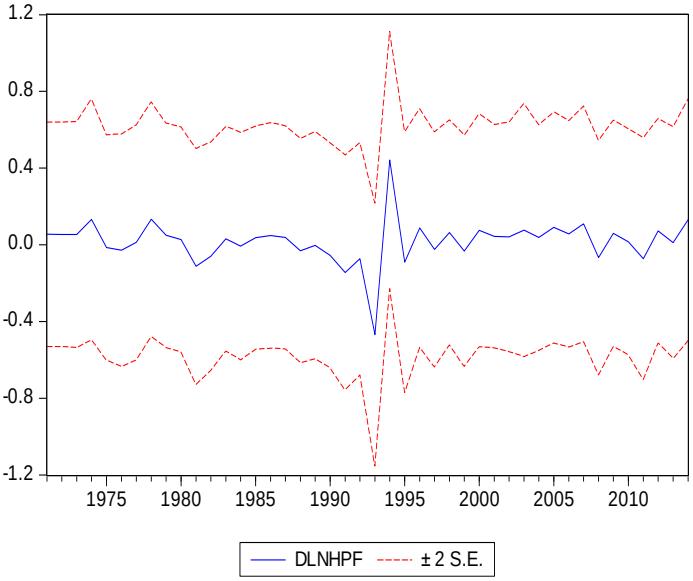
Source: Own computation, 2017

In considering the magnitude of collinearity, when $VIF(\beta_i) > 10$ then multicollinearity would be high and serious (Gujarati, 2004). In this case, both the uncentred and centred VIFs for all the exogeneous variables were less than 10 hence there was no evidence of serious multicollinearity.

4.2.3 Cointegration Test

Cointegration test was done to help establish whether there existed a long run economic relationship amongst variables under study. This study thus employed Engel and Granger two-step method. The two-steps involved estimating the cointegration regression model by OLS, and obtaining the residuals which were then tested for stationarity using Augmented Dickey-Fuller method. The housing growth model was estimated and the following forecast obtained.

Figure 4.1 Forecasted Value for Housing growth



Forecast: DLNHPF
Actual: DLNHP
Forecast sample: 1970 2014
Adjusted sample: 1971 2014
Included observations: 44

Root Mean Squared Error	0.270446
Mean Absolute Error	0.197713
Mean Abs. Percent Error	202.0948
Theil Inequality Coefficient	0.654598
Bias Proportion	0.000000
Variance Proportion	0.432653
Covariance Proportion	0.567347

Source: Own computation, 2016

The residuals from the forecast were then obtained, subjected to Augmented Dick-Fuller test for stationarity and yielded the results as shown in table 4.5 below;

Table 4.5 ADF test for residuals

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, max lag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.719348	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Source: Own computation, 2016

The residuals were thus found to be stationary at levels as the tau t statistics of -7.719348 was far more negative (left) as compared to -3.592462, -2.931404, and -2.603944 critical values at 1%, 5% and 10% respectively with Mackinnon p-value of 0.000.

This result signifies a long run relationship amongst the variables existed in Kenya and the parameters of Housing growth function could be interpreted as long run parameters. And since housing growth function did form a long run relationship, its parameters could be interpreted as long-term parameters and therefore a long run regression result will be consistent and

meaningful. This means that the results would be good for interpretation and forecasting in the long run.

The existence of cointegration between housing growth and exchange rates, savings interest rates, investment interest rates and inflation rates indicate that the variables have a long-term or equilibrium relationship. There however, may be disequilibrium in the short run and therefore Table 4.6 below give the short-run estimation.

Table 4.6 Short-run Model of Formal Housing Growth

Dependent Variable: DLNHP
Sample (adjusted): 1972 2014
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.043386	0.049714	0.872713	0.3884
DLNEXR	-0.445834	0.450919	-0.988722	0.3292
DLNINTS	0.077252	0.167053	0.462439	0.6465
DLNINTI	-0.270267	0.332788	-0.812129	0.4219
DLNINF	0.011385	0.056956	0.199891	0.8427
ECM (-1)	-0.186836	0.164843	-1.133423	0.2643

R-squared	0.183461	Mean dependent var	0.012370
Adjusted R-squared	0.073118	S.D. dependent var	0.298843
S.E. of regression	0.287710	Akaike info criterion	0.475064
Sum squared resid	3.062761	Schwarz criterion	0.720812
Log likelihood	-4.213866	Hannan-Quinn criter.	0.565688
F-statistic	1.662638	Durbin-Watson stat	2.036738
Prob(F-statistic)	0.167992		

Source: Own Computation, 2017

The coefficients for exchange rates, savings interest rates, investment interest rates and inflation rates were found insignificant in the short-run at the 18% or lower level. The short-run model was also found insignificant.

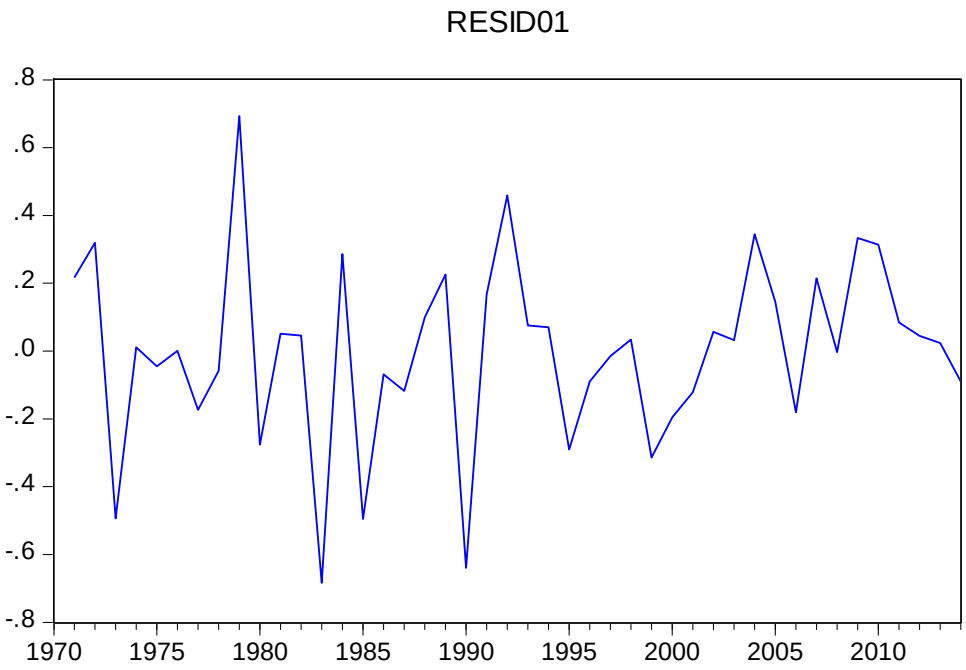
The coefficient of the error correction term of about -0.19 suggests that only about 19% of the discrepancy between long-term and short-term housing growth is corrected within a year suggesting a slow rate of adjustment to equilibrium.

4.2.4 Test for Autocorrelation

This test involved establishing if in the classical linear regression model the error terms, μ_t were correlated or uncorrelated, that is the error term at time, t was not correlated with the error term at time, $(t-1)$ or any other error term in the past.

According to Gujarati (2011), a rough and ready method of testing for autocorrelation is to simply plot the values of μ_t chronologically. The values of error terms plotted chronologically yielded the following graph;

Figure 4.2 Plotted values of Error terms



Source: Own computation, 2016

From figure 4.2 above, it is clear that there was no first order autocorrelation since the curve did not show a see saw pattern.

With a low R^2 of 0.156825 and a Durbin Watson statistic of 2.339277, the findings signalled the absence of autocorrelation. However, to ascertain this, the Breusch-Godfrey Serial Correlation (LM) test was used to test the null hypothesis of no serial correlation. The Breusch-Godfrey test was chosen because of its non-restrictive features.

The BG test involved testing the null hypothesis $(H_0 : \rho_1 = \rho_2 = ... = \rho_p = 0)$, that is, there is no serial correlation of any order. One lagged value of the residual was chosen in the regression because we did have annual data. The following results were obtained after running the BG test;

Table 4.7 B-G Test for Autocorrelation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.319016	Prob. F (1,38)	0.2579
Obs*R-squared	1.476047	Prob. Chi-Square (1)	0.2244

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/02/16 Time: 22:12
Sample: 1971 2014
Included observations: 44
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000813	0.048725	0.016690	0.9868
DLNEXR	-0.031459	0.447043	-0.070371	0.9443
DLNINTS	-0.025089	0.166106	-0.151040	0.8807
DLNINTI	0.066398	0.330737	0.200758	0.8420
DLNINF	0.005146	0.056322	0.091359	0.9277
RESID (-1)	-0.188242	0.163905	-1.148484	0.2579

R-squared	0.033547	Mean dependent var	1.73E-17
Adjusted R-squared	-0.093618	S.D. dependent var	0.273572
S.E. of regression	0.286092	Akaike info criterion	0.461115
Sum squared resid	3.110241	Schwarz criterion	0.704414
Log likelihood	-4.144531	Hannan-Quinn criter.	0.551342
F-statistic	0.263803	Durbin-Watson stat	2.019048
Prob(F-statistic)	0.930030		

Source: Own computation, 2016

The results above present the test statistics and associated probability values. The statistic "Obs*R-squared" was the LM test statistic for the null hypothesis of no serial correlation. The F-value as obtained from the regression as shown in table 4.6 was used to test the null hypothesis. This F-value had $(1,39)$ degrees of freedom in the numerator and denominator with five number of parameters in the OLS model. As the results show, there was a strong evidence of no first order autocorrelation for both the F and χ^2 values were insignificant because their P-values were in excess of 0.05 and hence we accepted the null hypothesis of no serial correlation in the residuals.

4.2.5 Test for Heteroscedasticity

The Breusch-Pagan test was used to test the presence of heteroscedasticity. The null hypothesis in this test involved testing if the error variance is homoscedastic, that is if all the slope coefficients in the regression were simultaneously equal to zero. After running the Breusch-Pagan test for the model with money market factors, the following results were obtained;

Table 4.8 B-P Test for Heteroscedasticity for Money Market factors

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.190818	Prob. F (4,39)	0.9418
Obs*R-squared	0.844596	Prob. Chi-Square (4)	0.9324
Scaled explained SS	0.893302	Prob. Chi-Square (4)	0.9255

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/19/16 Time: 14:55
Sample: 1971 2014
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.072883	0.021499	3.390029	0.0016
DLNEXR	0.006251	0.196902	0.031746	0.9748
DLNINTS	-0.011923	0.072663	-0.164085	0.8705
DLNINTI	0.021762	0.143702	0.151436	0.8804
DLNINF	-0.021401	0.024775	-0.863807	0.3930

Source: Own computation, 2016

Using the chi-square statistic, it could be shown that under the null hypothesis of homoscedasticity, the product of R^2 and the number of observations followed the chi-square distribution, with degrees of freedom equal to the number of regressors in the model. As results in table 4.7 above show, the observed chi-square value $\left(= nR^2\right)$ of about 0.844596 had a very high p-value of 93.24% suggesting that we could not reject the null hypothesis of homoscedasticity.

The F-statistic (4 df in the numerator and 39 df in the denominator) was also highly significant for its p-value was about 94.18%. Thus, we could not reject the null hypothesis. It could therefore be concluded that the regression did not suffer from the problem of heteroscedasticity.

The third version of the test statistic (Scaled explained SS) which was based on a normalized version of the explained sum of squares with p-values of about 92.55% from the auxiliary regression also suggested absence of heteroscedasticity.

A similar test but with extraneous variables included was run and yielded the following results;

Table 4.9 Test for Heteroscedasticity for all Variables, extraneous variables included

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.166797	Prob. F (8,33)	0.3479
Obs*R-squared	9.260647	Prob. Chi-Square (8)	0.3208
Scaled explained SS	9.474283	Prob. Chi-Square (8)	0.3039

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/19/16 Time: 14:54
Sample: 1973 2014
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.065912	0.022457	2.934966	0.0060
DLNEXR	0.103575	0.217158	0.476955	0.6365
DLNINTS	0.048181	0.075072	0.641796	0.5254
DLNINTI	-0.079651	0.151660	-0.525193	0.6030
DLNINF	-0.012952	0.024956	-0.518987	0.6072
D2LNGDPC	0.011840	0.040052	0.295614	0.7694
D2LNEMP	2.211246	0.855127	2.585869	0.0143
D2LNPOP	0.904694	3.187725	0.283806	0.7783
D3LNCHP	-0.033404	0.021524	-1.551943	0.1302

Source: Own computation, 2016

As results in table 4.8 above show, the observed chi-square value $\left(= nR^2\right)$ of about 9.260647 had a very high p-value of 32.08% suggesting that we could not reject the null hypothesis of homoscedasticity.

The F-statistic (8 df in the numerator and 33 df in the denominator) was also significant for its p-value was about 34.79%. Thus, we could not reject the null hypothesis of homoscedasticity. It could therefore be concluded that the regression did not suffer from the problem of heteroscedasticity.

The test statistic (Scaled explained SS) which was based on a normalized version of the explained sum of squares with p-values of about 30.39% from the auxiliary regression also suggested absence of heteroscedasticity.

4.3 Test for Normality

The Jarque-Bera (J-B) statistic is important in testing the normality of the residuals. If the residuals are normally distributed, the J-B statistic would not be significant. The reported probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis. This means that the P-value obtained would be bigger than 0.05 to not reject the null hypothesis of the normality at the 5% level. A small probability

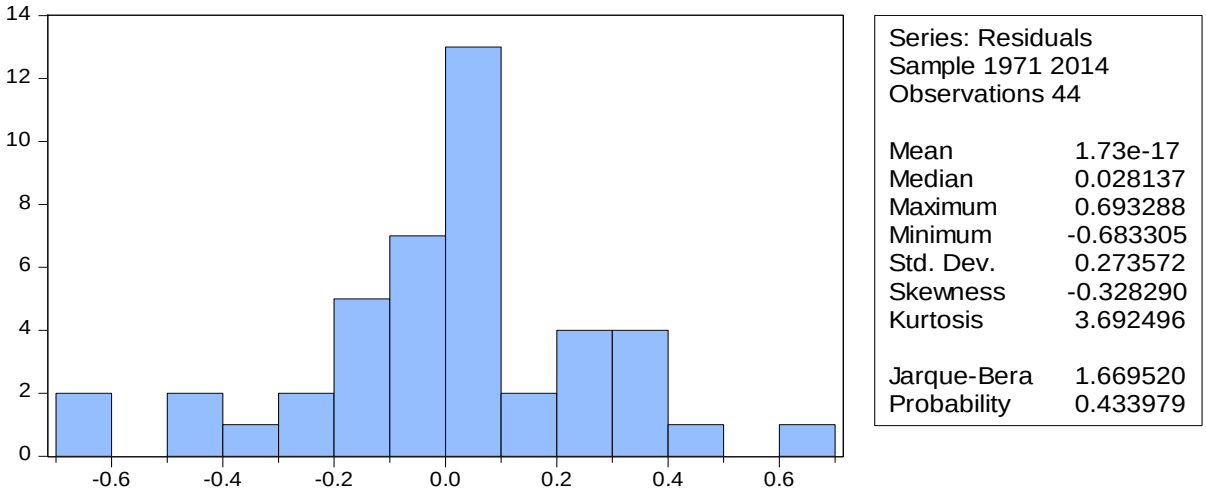
value would lead to the rejection of the null hypothesis of a normal distribution. The hypothesis of the Jarque-Bera test in this study was as follows:

H_0 : errors are normally distributed

H_1 : errors are not normally distributed

The test was run and the following output obtained;

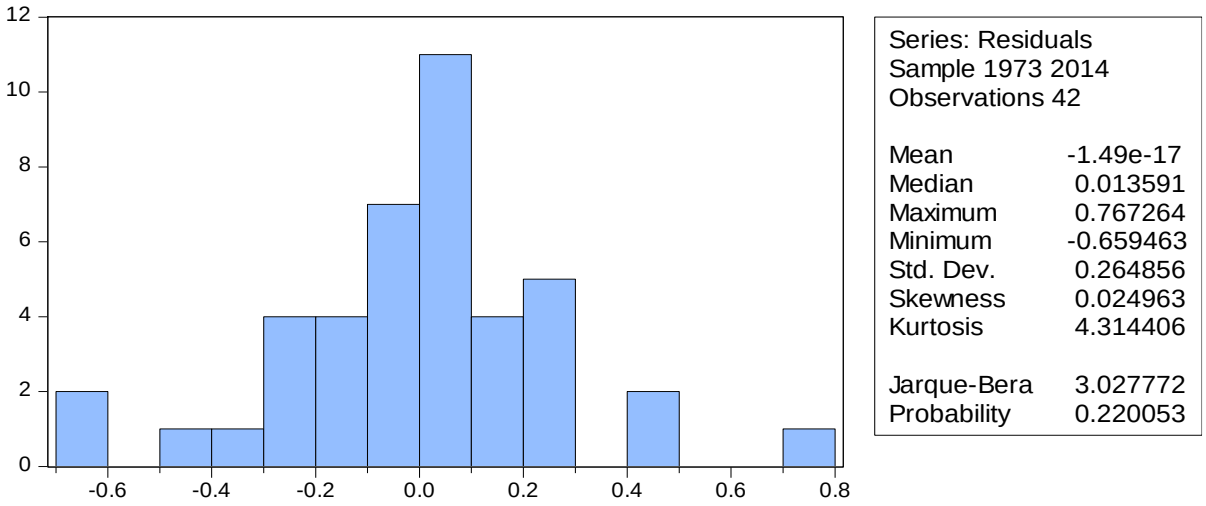
Figure 4.3 Test for Normality of Money Market factors



Source: Own computation, 2016

Looking at the Jarque-Bera statistic of 1.669520 (approx. equal to 2) and the P-value of 0.433979, it was concluded that the model with only the money market factors had residuals that were normally distributed. Hence, we accepted the null hypothesis of normal distribution and concluded that inferences we made about coefficient estimates were good.

Figure 4.4 Test for Normality for all variables, extraneous variables included



Source: Own computation, 2016

With extraneous variables included, a Jarque-Bera statistic of 3.027772 and a probability of 0.220053 showed that the model had normally distributed residuals hence the null hypothesis could not be rejected. It could thus be concluded that the inferences we made with the extraneous variables included were good.

4.4 RESET Tests

The Ramsey RESET test was used to test the functional form of the model. The following table results were obtained;

Table 4.10 Ramsey RESET Test

Ramsey RESET Test
Equation: EQ01
Specification: DLNHP C DLNEXR DLNINTS DLNINTI DLNINF
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.416678	38	0.6793
F-statistic	0.173620	(1, 38)	0.6793
Likelihood ratio	0.200576	1	0.6543

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.014637	1	0.014637
Restricted SSR	3.218201	39	0.082518
Unrestricted SSR	3.203564	38	0.084304

LR test summary:

	Value	df
Restricted LogL	-4.895218	39
Unrestricted LogL	-4.794930	38

Source: Own computation, 2016

Both F- and χ^2 versions of the test are presented, and it could be seen from the probability values (Prob>0.05) that there was no apparent non-linearity in the regression equation and so it could be concluded that the linear model for housing growth was appropriate.

4.5 Empirical Results

The presentation and discussion of the empirical results was undertaken as per the study objectives. The main objective of the study was to analyse the effect of money market factors on formal housing growth. Using the Akaike Information Criterion, a lag length of two for exchange rate and three for inflation rate were chosen.

Two regressions were performed; the first one involved regression of only money market factors on housing growth while the second one involved money market factors and extraneous variables.

4.5.1 Effect of Money market factors on formal housing growth

Exchange rates, savings interest rates, investment interest rates and inflation were regressed on housing growth and the results presented in table 4.10 below obtained;

Table 4.11 Long-run Estimation of Money Market factors on Housing growth

Dependent Variable: DLNHP
Method: Least Squares
Sample (adjusted): 1974 2014
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.061280	0.044010	1.392411	0.1723
DLNEXR (-2)	-0.586760	0.277011	-2.118179	0.0411
DLNINTS	0.043980	0.152196	0.288968	0.7743
DLNINTI	-0.484356	0.206717	-2.343086	0.0248
DLNINF (-3)	-0.082870	0.051176	-1.619313	0.1141

R-squared	0.286781	Mean dependent var	0.014616
Adjusted R-squared	0.207535	S.D. dependent var	0.292205
S.E. of regression	0.260123	Akaike info criterion	0.258523
Sum squared resid	2.435899	Schwarz criterion	0.467496
Log likelihood	-0.299729	Hannan-Quinn criter.	0.334620
F-statistic	3.618852	Durbin-Watson stat	2.249939
Prob(F-statistic)	0.014052		

Source: Own computation, 2016

The general objective was tested by looking at the overall significance of the model. The F-statistic was obtained as 3.618852 in the estimation table 4.10. The p-value of the F-statistic, Prob(F-statistic) was established to be 0.014052 and represented the marginal significance

level of the F-test. At 5% significance level, the p-value was below 0.05 hence we could reject the null hypothesis that all slope coefficients were equal to zero. Therefore, the model in this instance was significant with $(F = 3.618852; p = 0.014052)$ in explaining formal housing growth in Kenya.

The estimated model showed that if all the explanatory factors (money market factors) are zero, there would be no autonomous growth in formal housing since the constant was established to be insignificant.

The percentage of total variation of the dependent variable explained by the independent variables was found to be 20.75%. It could therefore be concluded that the model with exchange rate, interest saving rate, investment interest rate and inflation rates though significant was not exhaustive in explaining a formal housing growth model for Kenya.

4.5.1.1 Effect of Exchange rates on Formal Housing growth in Kenya

The first objective was to examine the effect of Exchange rates on formal housing growth in Kenya. Results in table 4.10 showed that a one per cent increase in exchange rate (Kenya shilling against US dollar) lagged two-year periods led to a 0.59% decline in the current number of houses produced.

At a significance level of 5%, the p-value for exchange rates lagged two periods was established to be less than 0.05 that is, 0.0411 which suggested that we could reject the null hypothesis that the exchange rates had no effect on formal housing growth in Kenya at 5% significance level. The alternative hypothesis that exchange rates had an effect on formal housing growth in Kenya was thus accepted and concluded that it was significant with $(\beta_1 = -0.59)$ and $(p = 0.0411)$ in influencing formal housing growth in Kenya. The first objective was therefore achieved.

This finding was similar to that by Xiaoling (2007) who established that exchange rate was a critical factor affecting housing supply in China and that when it was undervalued, supply of housing was found to be increasing. However, this study differed with that of Juma (2014) who established that there existed a positive relationship between exchange rate and real estate growth (which included formal housing) in Kenya for the period 2000-2013.

An increase in exchange rate is expected to significantly affect the total amount of cash available for housing development (in the local currency) obtained from foreign currency

inflows. This may be particularly so because most of the building materials or their raw materials are imported and paid for in foreign currencies and hence with high exchange rate, the purchasing power of the Kenya shilling would decline and hence less capital bought at the prevailing rates.

4.5.1.2 Effect of Savings interest rates on formal housing growth in Kenya

The second objective was to establish the effect of savings interest rates on formal housing growth in Kenya. The P-value for savings interest rates was found to be in excess of 0.05 that is, 0.7743 which suggested that we do not reject the null hypothesis that savings interest rates had no influence on formal housing growth in Kenya at 5% significance level and conclude that savings interest rates did not influence formal housing growth in Kenya. The second hypothesis was therefore not achieved.

However, this finding differed with that of Elmendorf (1996) who established that in the United States a decline in personal savings caused a decline in national savings which in turn led to increased housing development where returns were good. He advocated for measures to lower savings interest rates in order to increase housing development. The finding by Malhar (2011) in China also established that to increase housing development, measures to induce households to save less and spend more should be put in place.

4.5.1.3 Effect of Investment interest rates on formal housing growth in Kenya

The third objective was to examine the effect of investment interest rates on formal housing growth in Kenya. Results in Table 4.10 showed that a one percentage increase in investment interest rates in a year would decrease the number of formal housing units developed by 0.48% *ceteris paribus*. This could be due to the fact that higher investment interest rates made the cost of building more expensive. Borrowing will be more expensive hence few people would want to borrow at that particular time to invest in housing.

At a significance level of 5%, the p-value for investment interest rates was established to be less than 0.05 that is, 0.0248 which suggested that we could reject the null hypothesis that investment interest rates had no effect on the formal housing growth in Kenya at 5% significance level. The alternative hypothesis that investment interest rates had an effect on formal housing growth in Kenya was thus accepted and concluded that investment interest rates were significant with $(\beta_3 = -0.48)$ and $(p = 0.0248)$ in influencing formal housing growth Kenya. The third hypothesis was thus supported.

This finding was similar to that by Theodore & Panagiotis (2015) who showed that there existed a longrun inverse relationship between the retail sector, mortgage loans and housing development in Greece. He established that mortgage loans accounted for 29% of variation in housing and thus people tended to borrow more for housing development when the interest rates were low. This finding was also consistent with that of Kariuki (1993) who established an inverse relationship between cost of credit (which included interest rates) and housing supply in Kenya. Adala (1978) finding on the barriers to new residential construction that lack of access to credit finance due to high interest rates affected housing development negatively also was in harmony with the findings of this study. However, this study differed with that of Adams (2008) on the macroeconomic determinants of international housing markets. The study showed that a change in the short term interest rates affected construction of new houses and that interest rates positively affected housing growth which could not be the case in Kenya.

4.5.1.4 Effect of Inflation rates on formal housing growth in Kenya

The fourth objective was to establish the effect of inflation rates on formal housing growth in Kenya. The P-value for inflation rates lagged three periods were found to be in excess of 0.05 that is, 0.1141 which suggested that we do not reject the null hypothesis that inflation rates had no influence on formal housing growth in Kenya at 5% significance level and concluded that inflation rates were not significant in influencing formal housing growth in Kenya. The fourth hypothesis was thus not supported.

This finding however differed with that of Feldstein (1980) who explored the relationship between inflation and housing markets in Malaysia. He established a positive relationship between inflation rate and housing prices and as such inflation affected housing growth via the impact of input prices. He showed that when inflation was high, house prices would be high and thus housing growth would decline. This was also supported by Piazzesi & Scheineider (2009) who also showed existence of a negative relationship between inflation and housing growth.

4.5.2 Effect of money market factors with extraneous variables on formal housing growth

This model sought to establish the influence of extraneous variables on money market factors in affecting formal housing growth. The money market factors alongside GDP per capita, employment levels population growth and cost of housing development were regressed on formal housing growth and the results in table 4.11 below obtained;

Table 4.12 A Long run Estimation of Money Market factors and extraneous variables on Housing growth

Dependent Variable: DLNHP
Method: Least Squares
Sample (adjusted): 1976 2014
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056926	0.043337	1.313566	0.1989
DLNEXR (-2)	-0.643647	0.268923	-2.393428	0.0232
DLNINTS	-0.030778	0.157181	-0.195814	0.8461
DLNINTI	-0.436488	0.210021	-2.078305	0.0463
DLNINF (-3)	-0.072668	0.049497	-1.468146	0.1525
D2LNGDPC (-3)	0.179490	0.080797	2.221493	0.0340
D2LNEMP (-1)	-3.304488	1.821215	-1.814441	0.0796
D2LNPOP	-8.921191	6.421213	-1.389331	0.1750
D3LNCHP (-3)	0.075127	0.044119	1.702838	0.0989

R-squared	0.459755	Mean dependent var	0.013210
Adjusted R-squared	0.315690	S.D. dependent var	0.298823
S.E. of regression	0.247196	Akaike info criterion	0.241901
Sum squared resid	1.833170	Schwarz criterion	0.625799
Log likelihood	4.282939	Hannan-Quinn criter.	0.379640
F-statistic	3.191295	Durbin-Watson stat	1.881621
Prob(F-statistic)	0.009683		

Source: Own computation, 2016 *Extraneous Variable; GDPC, EMP, POP & CHP*

Using the Akaike Information Criterion, we also arrived at lag lengths of three for GDP per capita and cost of housing construction while a lag length of one for employment levels.

Based on the magnitude of the parameters, the above estimated model shows that if all the explanatory factors (inclusive of extraneous variables) were zero, there would be no formal housing growth since the constant was found to be insignificant similar to when only money market factors were considered.

On individual coefficients and holding other factors constant, a one per cent increase in exchange rate lagged two-year period leads to a 0.64% decline in the current number of houses produced compared to 0.59% when there were no extraneous variables. Exchange rates however remained significant in influencing formal housing growth.

The relationship between formal housing growth and savings interest rates was negative in this case unlike the positive one (0.04%) when there were no extraneous variables. However, just like in the case with no extraneous variables savings interest rates remained insignificant in influencing formal housing growth in Kenya with p-values in excess of 0.05.

A one percentage increase in investment interest rates in a year would decrease the number of houses developed by 0.44 % *ceteris paribus*. This compares with 0.48% when there were no extraneous variables. The investment interest rates also remained significant in influencing formal housing growth. Higher investment interest rates make the cost of building more expensive. Borrowing will be more expensive hence few people would want to borrow at that particular time to invest in housing.

The relationship between inflation rates and formal housing growth remained insignificant with addition of extraneous variables with p-values in excess of 0.05.

This study thus concluded that the addition of extraneous variables did not significantly alter the effect money market factors had on formal housing growth in Kenya over the study period since the findings did not present any substantial variation of the effect.

4.6 Conclusion

This study established that among the money market variables, exchange rates and investment interest rates are significant in influencing formal housing growth in Kenya. However, considering the superiority of the two models used, formal housing growth would require inclusion of other variables other than money market factors particularly GDP per capita since its inclusion improves the value of adjusted R^2 from 20.8% to 31.6% which is a better model.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter highlights the summary of findings and makes policy recommendations following issues that had emerged as a result of the analysis in results and discussions section.

5.2 Summary of Results

This study sought to establish the effect of money market factors on formal housing growth in Kenya over the period 1970-2014. The study specifically aimed at determining the relative importance of exchange rates, savings interest rates, investment interest rates and inflation on formal housing growth. To achieve the study objective, annual time series data for the period 1970 to 2014 was used to estimate a formal housing growth function. The tests for stationarity and cointegration were done to test stability of data and consequently avoid getting spurious results in the estimated function and to depict if there was a long run relationship between two or more non-stationary variables. Cointegration results established a long run relationship between money market factors and formal housing growth in Kenya. Ordinary least squares technique was used in estimating the relationship between formal housing growth and money market factors at 5% significance level.

The first objective sought to establish the effect of exchange rates on formal housing growth in Kenya. While the exchange rates of Kenya shilling against the US dollar were found to be fluctuating over the study period, it was generally on an upward trend. The estimation revealed that there was a negative significant relationship between formal housing growth and exchange rates implying that an increase in exchange rate would lower the number of formal houses developed in Kenya.

The second objective sought to establish the effect of savings interest rates on formal housing growth. However, test of significance established that savings interest rates were insignificant in the study period hence could not play a major role in formal housing growth.

The third objective sought to establish the effect of investment interest rates on formal housing growth. The estimation revealed a negative relationship between formal housing growth and Investment interest rates. Based on economic theory, the finding was in tandem since higher lending rates would imply that there would be low borrowing for housing development. Low

rates on the other hand would stimulate more borrowing hence increased formal housing development. The test of significance also established that investment interest rates were significant in determining formal housing growth.

The fourth objective sought to establish the effect of inflation rates on formal housing growth in Kenya. However, the test of significance showed that inflation rates were insignificant in determining formal housing growth hence could not be used for any significant policy on formal housing growth.

5. 3 Conclusions

The study concluded that exchange rates and investment interest rates were found to be statistically significant in influencing formal housing growth in Kenya over the study period. On the other hand, savings interest rates and inflation rates were found statistically insignificant in influencing formal housing growth in Kenya. All the coefficients had expected signs except the exchange rates. A percentage increase in the exchange rate would lower formal housing growth in Kenya. Similarly, an increase in investment interest rates would lower formal housing growth in Kenya. And since savings interest rates and inflation rates were found statistically insignificant, they could not be used for policy implications geared towards accelerating formal housing growth in Kenya.

5.4 Contribution to Knowledge

This study filled the academic gap that had been existing in the academic field as pertains the relationship between money market factors and formal housing growth in Kenya. The finding that exchange rates and investment interest rates significantly affected growth in formal housing was important in the study of housing economics. This finding increased existing knowledge as pertains establishment of critical factors that may help increase formal housing while reducing the existing deficits particularly in urban areas. It is also a benchmark upon which future researchers can build on in the study of housing and urban economics in general since this study showed a glaring gap in studies in the area.

5.5 Policy Implications

Based on the findings of this study, exchange rates and investment interest rates were found to be statistically significant in determining formal housing growth. With annual formal housing deficits being estimated at about 200,000 units, there is need to bridge this gap by adopting exchange rates and investment interest rates policies to realise formal housing growth.

First, emphasis should be put on strengthening the Kenya shilling against foreign currencies (exchange rates) through fiscal and monetary policies. This would for instance mean the value of one US dollar translates to more Kenyan shillings and will thus help in buying of more building materials that would otherwise be expensive as well as receive more remittances for construction purposes.

This study also advocates for lower investment interest rates. This could be done through the government setting up a fund which could offer financing at lower rates to private builders. The amount could be funded in phases to ensure they were used for production of formal housing. The lower investment interest rates would mean there would be reduced cost to facilitation of formal housing.

This study also established that savings interest rates and inflation rates were not statistically significant in influencing formal housing growth and therefore they could not be used for policy implication.

5.6 Limitations of the Study

This study focused on the effect of money market factors on formal housing growth. Figures for formal housing were obtained from the annual Economic Surveys published by the Kenya National Bureau of statistics. However, this data was only for the formal houses whose development was approved and their completion reported. This was on the premise that the relevant local authorities that control development of formal houses are efficient in their work and have adequate personnel to handle compliance to the extent that the number of formal residential houses was actually the number that was developed. However, this limitation was insignificant to alter the results of this study.

There was also a problem of establishing the actual number of formal houses developed. Authorities in the State Department of Housing and Urban Development estimate that while demand for formal houses stand at 250,000 units annually, only 50,000 units were being produced. These figures could however not be verified as available data from the Kenya National Bureau of Statistics, the custodian of statistical data in their economic surveys and statistical abstracts suggest different figures which were used in this study since the earlier estimates were not verifiable.

5.7 Suggestions for further Research

This study considered the monetarist side of formal housing growth. The effect of money market factors on formal housing growth was explored. However, the operation of any economic activity would also depend on the fiscal variables such as government spending, taxation and existing stock depreciation. It would thus be more important that a study be done in future on the effect of fiscal policy on formal housing development in Kenya.

While this study focused on varied money market factors, growth in housing units could also be affected by previous number of houses developed. It is therefore imperative that a study be done in future using an Autoregressive model of housing growth in Kenya. Since this study has established that exchange rates and investment interest rates significantly affect formal housing growth, this study suggests a future research using a Vector Autoregressive modelling of housing growth, exchange rates and investment interest rates in Kenya.

Further, this study recommends for a policy research to establish ways and levels in which exchange rate could be devalued and investment interest rates reduced to enhance growth in formal housing units in Kenya. Such a study can also focus on the appropriate policy focused on the private sector which has been established to be the main driver of formal housing growth.

REFERENCES

Abraham, J.M. & Hendershott, P.H. (1992). *Patterns and determinants of metropolitan house prices, 1977 to 1991.* Boston: M.A: Federal Reserve Bank of Boston.

Adala, P. (1978). *An Economic Study of the Urban Housing in Kenya.* (Dissertation, University of Nairobi, 1978). Dissertation Abstract.

Adams, F. (2008). *Macroeconomic Determinants of International housing markets.* Dissertation, London School of Economics. United Kingdom.

Adams, Z., & Füss, R. (2010). Macroeconomic determinants of international housing markets. *Journal of Housing Economics, 19*, 557-687.

Baffoe-Bonnie, J. (1998). The Dynamic Impact of Macroeconomic Aggregates on Housing Prices and Stock of Houses: A National and Regional Analysis. *Journal of Real Estate Finance and Economics, 17(2)*, 179-197.

Ballesteros, M. (2002). *The Dynamics of Housing Demand in the Phillipines; Income and Lifecycle effects.* Phillipine Institute for Development Studies.

Benoit, K. (2011). *Linear Regression Models with Logarithmic transformations.* United Kingdom: Dissertation, London School of Economics.

Bernanke, B.S., & Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives, 9 (4)*, 27-48.

Biddle, J. (2012). Retrospectives: The Introduction of the Cobb-Douglas Regression. *Journal of Economics, 26*(2), 223-236.

Branson, W. (1989). *Macroeconomic Theory and Policy* (3rd ed.). New York: Harper & Row.

Breusch, T. & Pagan, A. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. *Econometrica, 47*, 1287-1294.

Breusch, T.S. (1978). Testing for Autocorrelation in Dynamic Linear Models. *Australlian Economic papers*(17), 334-355.

Chesang, C. (1991). *Determinants of Private Investment in Urban Housing in Kenya.* Dissertation, University of Nairobi: Kenya.

Chiang, A. (1984). *Fundamental Methods of Mathematical Economics.* New York: Mc Graw-Hill.

Elmendorf, D. W. (1996). *The effect of interest rate changes on household saving and consumption; a survey.* Newyork: Research report.

Erguden, S. (2001). *Low-Cost Housing: Policies and Constraints in Developing Countries.* United Nations Centre for Human Settlements (Habitat).

Feldstein, M. (1980). Inflation, tax rules and the prices of land and gold. *Journal of Public Economics, 14(3).*

Glaeser, E.L., Gyourko, J. & Saiz, A. (2008). Housing Supply and Housing Bubbles. *Journal of Urban Economics, 64 (2),* 198-217.

Godfrey, L.G. (1978). Testing Against General Autogressive and Moving Average Error models when the Regressor include Lagged variables. *Econometrica*(46), 1293-1302.

GoK. (1968). *Statistical Abstract.* Nairobi: Government printer.

GoK. (1969-2015). *Economic Surveys.* Nairobi: Government Printer.

GoK. (1979-2009). *Kenya Census Reports.* Nairobi: Government Printer.

GoK. (1979-2014). *Statistical Abstracts.* Nairobi: Government Printer.

GoK. (2004). *National Housing Policy for Kenya, sessional paper no. 3.* Nairobi: Government Printer.

GoK. (2008). *The Kenya Vision 2030.* Nairobi: Government Printer.

GoK. (2012). *Kenya National Housing Survey; Basic Report.* Nairobi: Survey Report.

Granger, C.W. & Newbold, P. (1974). Spurious Regression in Econometrics. *Journal of Econometrics, 2*.

Griffiths, A. & Wall S. (2004). *Applied Economics.* Harlow: Pearson education Ltd.

Gujarati, D. (2011). *Econometrics by Example.* New York: Palgrave Macmillan.

Gujarati, D. N. (2004). *Basic Econometrics.* West Point: McGraw-Hill companies.

Handa, J. (2009). *Monetary Economics* (2nd ed.). New York: Routledge 270 Madson.

Hyman, D. (1994). *Macroeconomics* (3rd ed.). Massachusetts: Richard D. Irwin,Inc.

Iacoviello, M. & Minetti, R. (2003). *Financial liberalization and the sensitivity of house prices to Monetary Policy: Theory and evidence.* Manchester: Manchester School.

Ireri, F. (2010, July 19). Monday View. *Daily Nation*, p. 27.

Jhingan, M. (1999). *Microeconomic Theory* (5th ed.). New Delhi: Vrinda publications Ltd.

Juma, M. I. (2014). *The Effect of Macroeconomic Variables on Growth in Real Estate Investment in Kenya.* Dissertation, University of Nairobi. Kenya.

Kariuki, P. (1993). *Factors affecting Supply for Houses in Kenya.* (Dissertation, University of Nairobi, 1993). Dissertation Abstract.

Kombo, D. & Tromp, D. (2006). *Proposal and Thesis Writing.* Nairobi: Tromp Paulines.

Koop, G. (2013). *Analysis of Economic Data* (4th ed.). West sussex: John Wiley & Sons Ltd.

Kothari, C. (2003). *Research Methodology, Methods and Techniques.* New Delhi: Wishwa Prakshan.

Kothari, C.R. (2004). *Research Methodolgy: Methods and Techniques* (2nd Revised ed.). New Delhi: New Age International Limited.

Lastrapes, W. (2002). The Real Price of Housing and Money Supply Shocks: Time Series Evidence and Theoretical Simulations. *Journal of Housing Economics, 11*(1), 40-74.

Malhar, N. (2011). *Targets,Interest Rates and Household Saving in Urban China.* International Monetary Fund.

Marx, B., Stoker, T & Suri, T. (2013). The Economics of Slums in the Developing World. *Journal of Economics Perspective*, 83-119.

McConnel, C.R. & Brue, S.L. (1998). *Economics; Principles, Problems and Policies.* Boston: Irwin McGraw-Hill.

Ministry of Housing. (2011). *Draft Housing Bill.* Nairobi.

Mwania, P. (2010). *Residential Housing Demand in Kenya.* (Dissertation, University of Nairobi). Dissertation Abstract.

Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches.* London; England: Pearson Education Limited.

Piazzesi, M. & Scheineider, M. (2009). Momentum Traders in the Housing Market: Survey Evidence and a search model. *American Economic Review: Papers and Proceedings 99(2).*

Piotrowska, M. (2013). *Factors Influencing the Money Market.* Poland: Research report.

Russell, D. & Mackinnon, G.J. (1999). *Foundations of Econometrics.* Oxford: Oxford press.

Samuelson, P. (1970). *Economics* (8th ed.). New York: Mc Graw Hill Book company.

Samuelson, P. A. (1980). *Economics* (11th ed.). New York: Mc Graw Hill Book company.

Sargan, J.D. & Bhargava, A.S. (1983). Testing Residuals from Least Squares Regression for being Generated by the Gaussian Walk. *Econometrica*(51).

Scanlon, K & Whitehead, C. (2007). *Social Housing in Europe.* London: London school of Economics.

Seed house, D. (1986). *Health: Foundations for Achievement.* Chichester: Wiley and Sons Ltd.

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *Journal of Finance*, 425-42.

Solow, R. W. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*.

Syagga, P. (1994). *Real Estate Valuation Handbook.* Nairobi: University of Nairobi Press.

Theodore, P & Panagiotis, P. (2015). *On the Macroeconomic Determinants of the Housing Market in Greece; A VECM Approach.* London: London School of Economics and Political Science.

UN Habitat. (2010). *State of the World's Cities 2010/2011: Bridging the Urban Divide.* London: Earthscan.

UN Habitat. (2012). *Zambia Urban Housing Sector Profile.* Nairobi, Kenya: UNON publishing services section. Retrieved march 29, 2015, from [www.unhabitat.org]

UN Habitat. (2013). *Scaling up affordable Housing Supply in Brazil: the 'my house my life' programme.* Nairobi: UNON. Retrieved March 29, 2015, from [www.unhabitat.org]

United Nations. (2003). *The Challenge of Slums:Global Report on Human Settlements.* United Nations: United Nations Human Settlement Programme.

Wagura, J. (2013). *Determinants of Housing Supply in Kenya.* Disseration, University of Nairobi. Kenya.

Xiaoling, L. (2007). *Analysis of the current high housing prices in China and possible policies.* Dissertation, Royal Institute of Technology. Sweden.

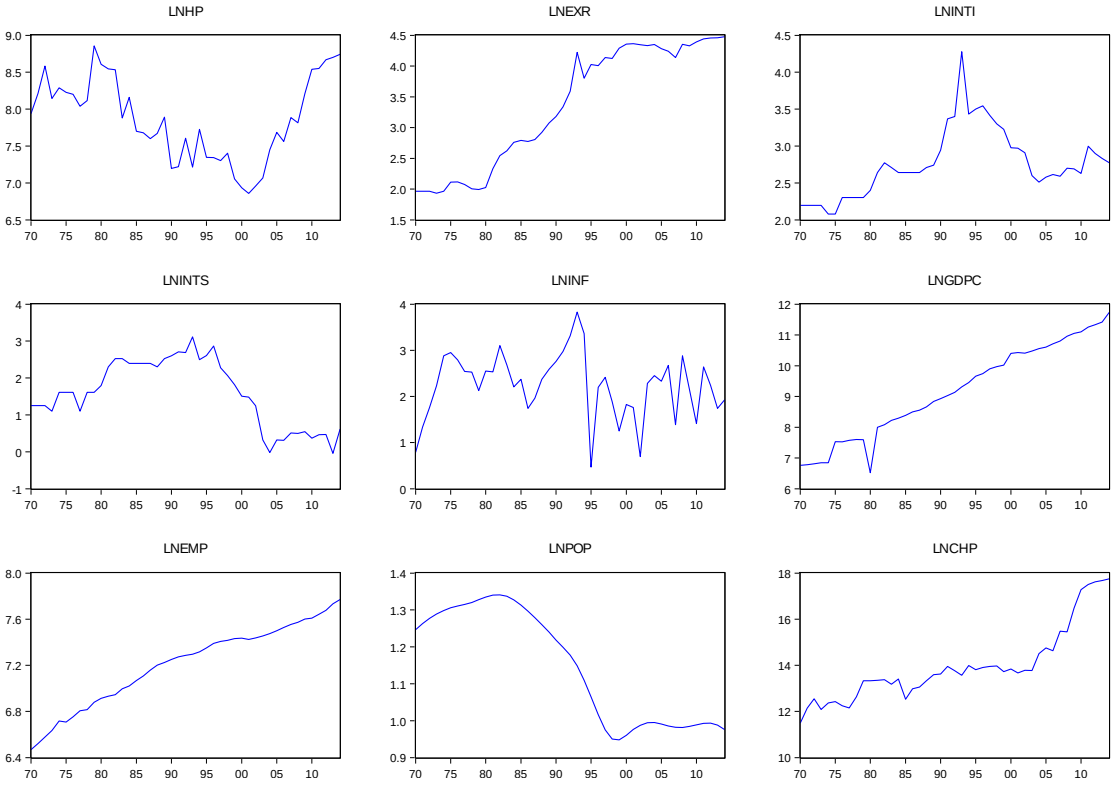
APPENDICES

SCHEDULE OF TIME SERIES DATA

	HP (NO)	EXR (Kshs/USD)	INTS (%)	INTI (%)	INF (%)	GDPC (Kshs)	EMP ('000)	POP (%)	CHP ('000)
1970	2806	7.1430	3.50	9.00	2.2	864.4	644.50	3.479	98200
1971	3683	7.1430	3.50	9.00	3.8	878.0	679.70	3.536	188342
1972	5349	7.1430	3.50	9.00	5.8	907.2	719.80	3.586	282286
1973	3443	6.9000	3.00	9.00	9.3	938.8	761.40	3.630	178190
1974	3974	7.1430	5.00	8.00	17.8	940.6	826.30	3.664	236382
1975	3745	8.2600	5.00	8.00	19.1	1863.0	819.10	3.692	249790
1976	3642	8.3100	5.00	10.00	16.3	1846.0	857.50	3.710	207462
1977	3102	7.9470	3.00	10.00	12.7	1939.4	902.90	3.725	190048
1978	3342	7.4040	5.00	10.00	12.5	1996.4	911.50	3.745	307110
1979	7022	7.3280	5.00	10.00	8.4	1984.8	972.30	3.772	615870
1980	5473	7.5680	6.00	11.00	12.8	678.4	1005.80	3.799	618652
1981	5145	10.2860	10.00	14.00	12.6	2978.4	1024.30	3.819	627446
1982	5074	12.7250	12.50	16.00	22.3	3228.8	1038.00	3.823	647712
1983	2643	13.7600	12.50	15.00	14.6	3712.0	1093.30	3.808	531800
1984	3493	15.7810	11.00	14.00	9.1	3989.2	1119.70	3.771	661120
1985	2208	16.2840	11.00	14.00	10.7	4389.0	1174.40	3.718	277140
1986	2165	16.0420	11.00	14.00	5.7	4901.6	1220.50	3.657	435460
1987	2000	16.5150	11.00	14.00	7.1	5191.6	1285.40	3.593	468280
1988	2141	18.5990	10.00	15.00	10.7	5790.0	1341.30	3.525	618880
1989	2677	21.6010	12.50	15.50	13.3	6892.0	1372.80	3.455	805700
1990	1335	24.0840	13.50	19.00	15.8	7562.0	1409.40	3.382	823320
1991	1366	28.0740	15.00	29.00	19.6	8334.0	1441.70	3.316	1145960
1992	2011	36.2160	14.75	30.00	27.5	9286.0	1461.90	3.247	949600
1993	1358	68.1630	22.50	72.00	46.0	11054.0	1475.50	3.154	777340
1994	2267	44.8390	12.15	30.93	28.8	12754.0	1505.50	3.032	1186280
1995	1549	55.9390	13.60	33.14	1.6	15602.2	1557.00	2.899	991660
1996	1545	55.0210	17.60	34.60	9.0	16992.0	1618.80	2.763	1095140
1997	1485	62.6300	9.77	30.43	11.2	19820.6	1647.40	2.652	1145000
1998	1638	61.8300	7.89	27.13	6.6	21322.4	1664.90	2.587	1169200
1999	1159	72.9310	6.15	25.19	3.5	22409.2	1688.20	2.580	915200
2000	1028	78.0360	4.51	19.60	6.2	32771.0	1695.40	2.612	1028310
2001	952	78.6000	4.40	19.49	5.8	33743.0	1677.10	2.654	862400
2002	1050	77.0723	3.47	18.34	2.0	33186.0	1699.70	2.685	972400
2003	1172	76.1389	1.38	13.47	9.8	35432.0	1727.30	2.704	956080
2004	1719	77.3444	0.98	12.30	11.6	38393.0	1763.70	2.705	2008600
2005	2175	72.3667	1.38	13.16	10.3	40292.0	1807.70	2.694	2556300
2006	1923	69.3967	1.36	13.67	14.5	44899.0	1857.60	2.679	2271170
2007	2659	62.6800	1.67	13.32	4.0	49128.0	1909.80	2.670	5281000
2008	2479	77.7100	1.65	14.87	17.8	57427.5	1943.90	2.668	5133900
2009	3673	75.8200	1.73	14.76	8.6	62784.7	2000.10	2.676	14373800
2010	5105	80.7500	1.45	13.87	4.1	66229.2	2016.62	2.687	32064500
2011	5167	85.0700	1.59	20.04	14.0	77061.2	2084.10	2.698	39860500
2012	5812	86.0300	1.60	18.15	9.4	83723.7	2155.80	2.700	44853000
2013	6016	86.3100	0.96	16.99	5.7	90876.2	2283.10	2.686	47404000
2014	6269	87.9200	1.85	15.99	6.9	124710.0	2370.20	2.653	51191300

TEST FOR STATIONARITY: Individual Series Graphs for Trend and Intercept

Series at Levels



Differenced Series