Discussion Paper Series

Is There a Real Estate Market Boom or Bubble in Urban Kenya: A Case Study of Residential Real Estate in Nairobi Metropolitan Region

Casty Gatakaa Mbae/Njoroge

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THE KENYA INSTITUTE FOR PUBLIC POLICY RESEARCH AND ANALYSIS (KIPPRA)

YOUNG PROFESSIONALS (YPs) TRAINING PROGRAMME

Is There a Real Estate Market Boom or Bubble in Urban Kenya? A Case Study of Residential Real Estate in Nairobi Metropolitan Region

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Infrastructure and Economic Services Division
Kenya Institute for Public Policy
Research and Analysis

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The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

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Abstract

Real estate is a basic need and the largest component of human wealth. Therefore, a change in real estate prices has a significant impact on individuals' welfare and investment decisions. In Kenya, and particularly Nairobi and its environs, real estate prices have skyrocketed especially since 2003. This has raised concerns and fears that the real estate market is experiencing a bubble. This study tests the view that a bubble exists in the urban real estate market in Kenya. Quarterly data for the period 2002-2009 sourced from private real estate firms, mortgage lending institutions, the Central Bank of Kenya, and the Ministry of Lands was analyzed. Cointegration test was performed to establish the existence of any bubble. The test rejected the hypothesis of residential real estate price bubbles in urban Kenya. The residential real estate price escalation can be explained by economic fundamental changes in the country, among them real GDP, interest rates, financial credit on building and construction, and population growth. Public policies that have been proposed included land banking to curb speculation and urban sprawl, increased financial credit on building and construction to facilitate supply of more houses, declaration of source of money for real estate acquisition to deter money laundering in the real estate market and finally, establishment of a real estate database to ensure information symmetry and provide data for analysis and decision making in real estate sector. The study was highly constrained of data, hence rejection of bubble phenomenon should not be taken without caution. Nonetheless, the study lays the ground for further investigation into the escalation of real estate prices in the Kenyan urban market.

Abbreviations and Acronyms

ADF	Augmented Dickey-Fuller
ARIMA	Autoregressive Integrated Moving Average
BCONS	Financial Credit on Building and Constructions
CBD	Central Business District
CBLR	Commercial Bank Lending Rates
DF	Dickey-Fuller
DREM	Diaspora Remittances
ECM	error correction model
EMH	Efficient Market Hypothesis
GDP	Gross Domestic Product
GoK	Government of Kenya
HSEPRICE	Real estate prices
IMF	International Monetary Fund
NESC	National Economic and Social Council
NHC	National Housing Corporation
OLS	Ordinary Least Squares
POP-NRB	Population growth in Nairobi
PP	Phillips and Perron
REPRICE	Real Estate Prices
RGDP	Real Gross Domestic Product Per Capita
TBINTR	Treasury Bills Real Risk Free Rate
USA	United States of America
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UK	United Kingdom
UNRISD	United Nations Research Institute for Social Development
VAR	Vector Autoregressive Models

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1. Introduction

1.1 Background

Real estate is a legal term that encompasses land, along with improvements to the land such as buildings, fences, wells and other sites that are fixed in location and are immovable (Hanken, 1930). For purposes of this study, real estate refers to land or housing. For most persons, real estate is the largest component of their wealth. Therefore, fluctuations in real estate prices have a significant impact on individual investment decisions, which in turn may influence growth in the macro economy (Clapp and Giaccotto, 1992). Real estate is recognized as a basic need or human right whereby every person should afford or be provided with, hence states should ensure that the percentage of housing-related costs is, in general, commensurate with income levels (Jensen, 2003). Real estate is also used as collateral for loans, hence price fluctuations make it a security risk to the banks.

Real estate boom occurs when prices increase based on economic fundamentals. That is when a country is experiencing a period of economic success. When rapid increase in real estate prices occurs that cannot be explained from theoretical values or rational economic fundamentals, it is described as price bubble, while a sharp decline after a surge in price is described as a "burst of bubble" (Abraham and Hendershott, 1996; Smith and Smith, 2006).

Some of the countries reported to have experienced major real estate market bubbles include the United States of America (USA), United Kingdom, India, Japan, and Spain (Ayuso and Restoy, 2003; and Case and Shiller, 2003). Real estate speculation, together with poor planning, increased cheap access to finance or lax lending standards, the traditional land valuation system, politics, slow provision of infrastructure and services, and poor land information systems are cited to have caused the bubble in these countries (UNESCAP, u.d ; and Negrao, 2004).

In Kenya, and especially in Nairobi and its environs, real estate prices have skyrocketed especially in the last five years. According to a government report presented in parliament by the Minister of Housing, "property prices have risen by 100 per cent in four years from 2004" (Standard, 14th June 2009). Property agents reported that property prices tripled in 3-5 years, and cited Karen (from Ksh 5 million per

acre in 2005 to 15 million in 2009), and Kileleshwa Estate (from Ksh 30 million per acre in 2006 to 60 million in 2009). Similar increases were reported along Thika Road, Ngong Road, Kiambu Road, Eastleigh Estate, Upper Hill and other estates at the peri-urban of Nairobi city and within Nairobi Metropolitan.

The aim of this study is to review the real estate market in urban Kenya in order to establish possibilities of a price bubble.

1.2 Problem Statement

Past literature provides some tentative evidence in support of the view that speculation on the expected future housing prices is an important force that drives increase in property prices (Garino and Sarno, 2004; Clapp and Giaccotto, 1992; and Karla *et al.*, 2000). Rampant property speculation can drive the prices beyond the productive value or to unsustainable levels, causing a "bubble". High prices lead to un-affordability of housing, which violates human rights. Those who are unable to rent or buy houses are forced to move to slums. This is followed by a bubble burst where land prices decrease significantly, resulting in many mortgagees finding themselves in a position of negative equity; that is, a mortgage debt higher than the value of the property, which makes it impossible to service mortgages (Fujii, 2002).

Though it has not been established that a property bubble exists in the urban Kenya market, concerns of ongoing property price escalation have been repeatedly raised by the press and policy makers. According to the local newspapers (Daily Nation), a bank was reported to "have financed an estimated 500,000 houses in 2003-2009" and feared that "with the rising inflation, many Kenyans who secured mortgages might start experiencing difficulties servicing their loans". It was also noted that financial sector is developing policies aimed at enabling ordinary Kenyans access mortgage facilities at competitive rates, and some are working on having a full 100 per cent mortgage financing facility for all qualified homebuyers. A Kenyan magazine (Construction Kenya, 1 July 2009) quoted a Permanent Secretary reporting that "the prices of houses and rent charges in Kenya have skyrocketed in the last few years, with speculation that the money invested into the real estate sector could be proceeds from illegal business and piracy". Internationally, it has also been reported (East African, 22 February 2010) that "rent in many parts of Nairobi suburbs are facing a property price bubble as they have not increased at the same pace as property prices."

Due to the above real estate price escalation and comments from the media, it raises concerns not only to researchers but also to property investors, mortgage lenders and policy makers involved in real estate and financial market. The study aims to test the possibility of a price bubble, and advice on policy measures that would lead to a sustainable real estate market in urban Kenya.

1.3 Objectives of the Study

The objectives of this study are:

(i) To examine real estate price trends in selected estates in Nairobi Metropolitan Region

(ii) To determine the existence of a bubble or boom in real estate in Nairobi Metropolitan Region

(iii) To recommend policy measures that would lead to sustainable real estate market

1.4 Research Questions

The following research questions respond to the problems outlined above and seek to address existing research gaps.

1. Can the real estate price changes in Nairobi be explained by economic fundamentals?
2. Is there real estate bubble or boom in urban Kenya?
3. What policies are needed to promote sustainable urban real estate market?

1.5 Justification

Achieving an adequately housed nation is an aspiration of any government, since housing is a basic need. Policies that ensure adequate and affordable housing to citizens or encourage home ownership are essential to achieving this goal. The Kenya Vision 2030 (Government of Kenya, 2007) envisages a robust housing sector as a critical component of sustainable infrastructure development and management. Experiences from other countries shows that a bubble in real estate pushes the prices so high that many people may fail to afford

shelter, while a bubble burst can lead to loss of many families' wealth or the collapse of the financial economy of the country. Unfortunately, general perceptions on the existence of a real estate bubble in Kenya are not grounded on any research, hence the need for this study to fill the gap.

2. Real Estate Market in Nairobi Metropolitan

2.1 Background Information

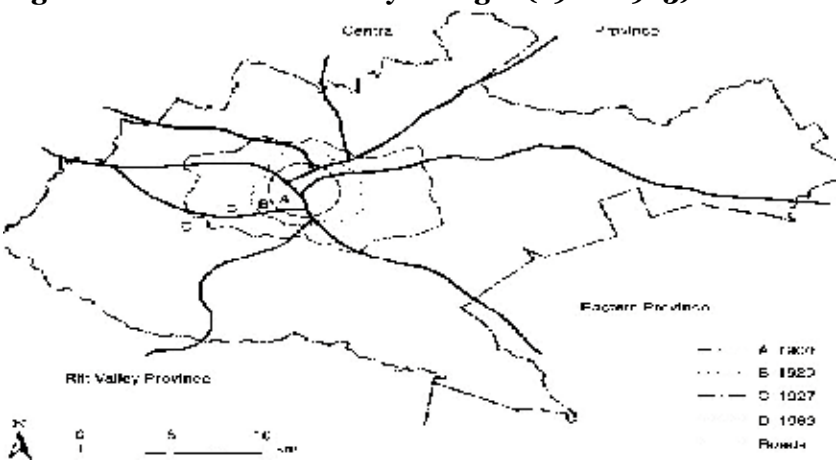
2.1.1 Spatial development of Nairobi

Nairobi the capital city of Kenya owes its birth to the Kenya- Uganda railway. The moving of the railway headquarters from Mombasa to Nairobi in 1899 resulted in the subsequent growth of Nairobi as a commercial and business hub (Olima, 2001). By 1900, Nairobi settlement consisted of railway buildings and separate areas for Europeans and Indians. The boundary of Nairobi as an urban centre was defined in 1900 (Mitullah, 2003).

Iy 1927, the boundary of the city was extended to cover 30 square miles (77km²) as a result of growth of the urban centre both in terms of population and infrastructure. From 1928-1963, the boundary remained the same, with only minor additions and excisions taking place. In 1963, the boundary was extended to cover an approximately 266 square miles (686 km²). The boundary changes are as shown on Figure 2.1.

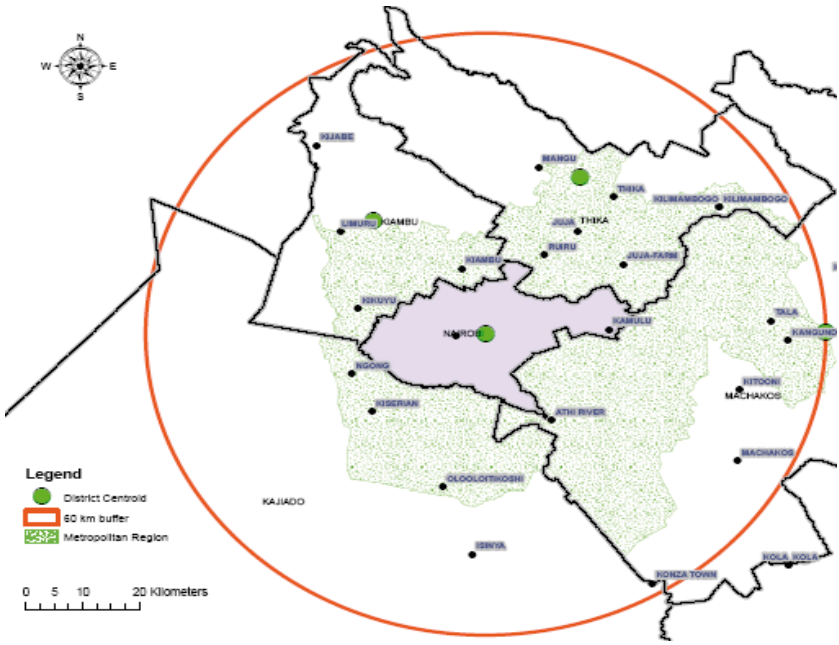
According to the Government of Kenya (2008c), the city has expanded further to the neighbouring satellite towns to cover over 3,000 km² (Figure 2.2).

Figure 2.1: Nairobi boundary changes (1900-1963)



Source: Mitullah, 2003

Figure 2.2: Nairobi boundary changes: 2008



Source: Government of Kenya (2008c)

2.1.2 Population growth

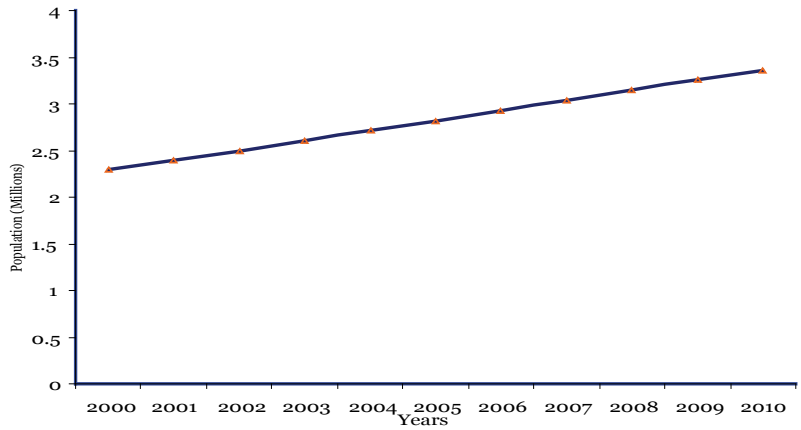
In 30-40 years, Nairobi has experienced tremendous populationgrowth at an average of 4.8 per cent per annum. This population growth is quite high compared to Kenya's average national growth rate of 3.4 per cent per annum (Omwenga, 2008). Nairobi's population increased from about 0.8 million in 1989 to 2.1 million in 1999, and estimates for 2010 are 3.4mn (Figure 2.3).

2.2 Real Estate Price Trends in Nairobi Metropolitan Region

For the last 20 years, land prices in Nairobi and environs have risen gradually, but escalated from 2003, gaining high momentum in 2006. The same trend was found in all zones, low, medium and high income estates (Figures 2.4, 2.5, and 2.6).

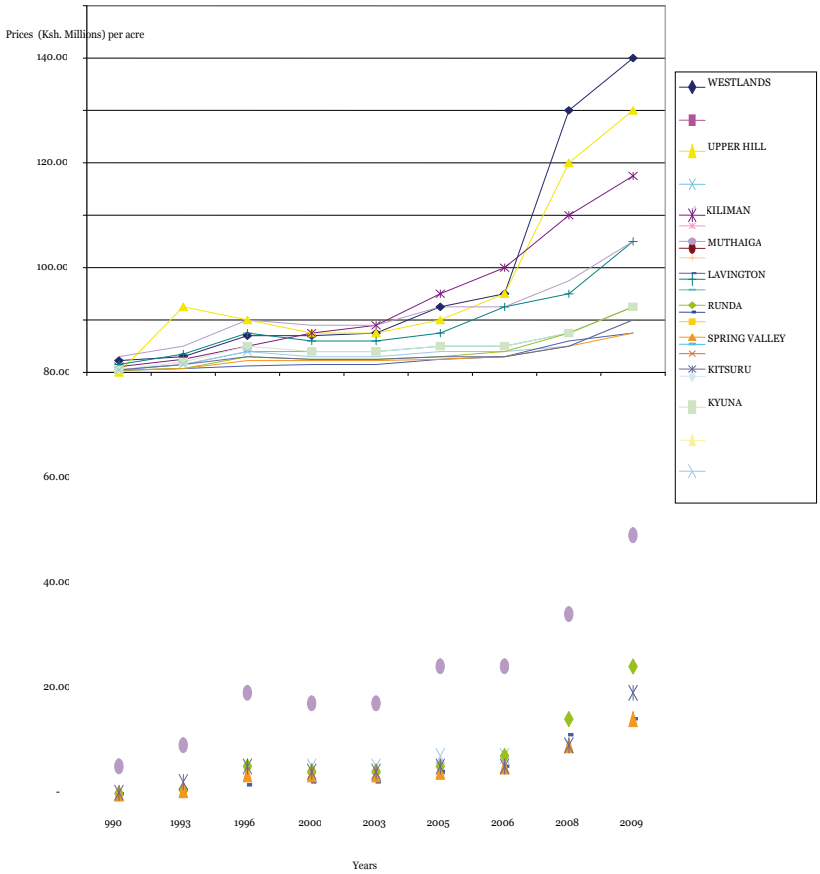
Similar trends were found in housing prices; the prices rose drastically in 2003, escalated in 2006, and by 2009, they were 3 to 5 times that of 2003 price as presented on Figure 2.7.

Figure 2.3: Projected population growth in Nairobi



Source: Government of Kenya (2007)

Figure 2.4: Land prices trend: High income estates (1996-2009)



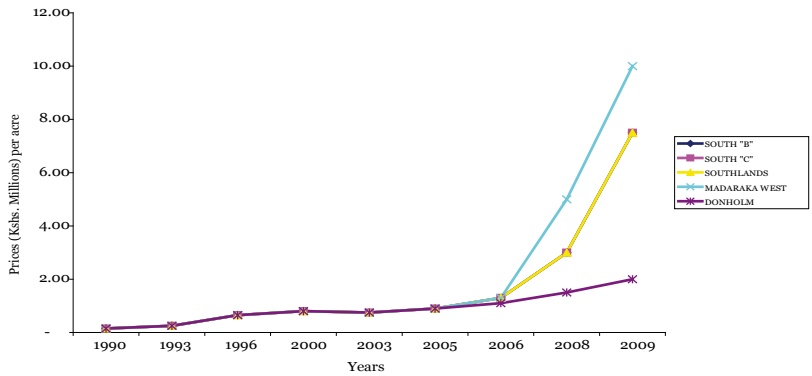
Source: Housing Finance (2010)

2.3 Housing Price-Rent Ratio in Nairobi

Analysis of price-rent ratio on selected houses was done to test the sustainability of the prices. Theoretically, the fundamental value of a house can be interpreted as the present value of all rental incomes generated in the future. According to Yuelay (2004), a rational price-rent ratio should be about 100 and should not exceed 250. Whenever it exceeds the stated ratio, it is a sign of prices deviating from the economic fundamentals and shows that the price is not sustainable. Price-rent ratio refers to the ratio of the transaction price of housing (price for short) to the rental value of the house (rent for short) . It is calculated as:

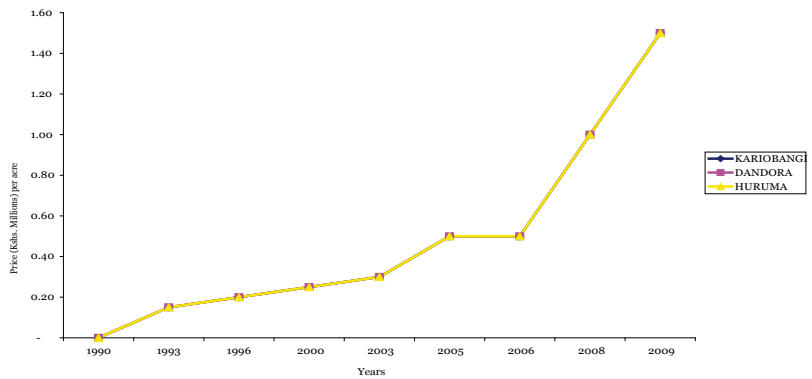
$$PRICE - RENT - RATIO = \frac{REALESTATEPRICE}{MONTHLYRENT * 12}$$

Figure 2.5: Land price trend: Middle income estates (1996-2009)



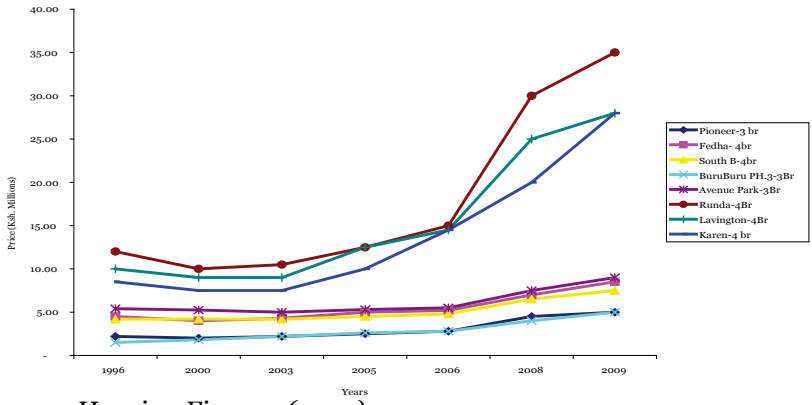
Source: Housing Finance (2010)

Figure 2.6: Land price trend: Low income estates



Source: Housing Finance (2010)

Figure 2.7: Housing prices trends: Selected estates



Source: Housing Finance (2010)

The results are presented in Table 2.1.

Analysis reveals that some properties had price-rent ratio higher than the acceptable levels, while others had lower levels. Though this can be noted as a sign of overpricing, the mean price-rent-ratio is 254, which makes the results debatable.

Table 2.1: Housing rents, price, payback period and price-rent ratios

Estate/ location	Type	Size	Estimated Rent	Market price (million)	Date of sale	Rate of return (%)	Payback period (years)	Annual net income	Price rent ratio
Westlands	Apartment	4Br	40,000	15.0	2009	2.72	26	408,000	375
Donyo Sabuk lane	Maisonette	5Br	100,000	24.0	2009	4.25	16	1,020,000	240
Off -Waiyaki Way	Duplex	2Br	50,000	12.5	2009	4.08	16	510,000	250
Kijani Willows	Town House	5Br +Sq	100,000	28.0	2009	3.64	18	1,020,000	280
Ngong Rd	Apartment	4Br +Sq	80,000	16.5	2008	4.95	13	816,000	206
Langata Rd	Apartment	3Br	25,000	4.55	2009	1.7	15	255,000	182
Nairobi West	Maisonette	3Br	30,000	7.0	2009	4.37	15	306,000	233
Parklands	Maisonette	2Br	28,000	7.5	2008	3.81	18	285,000	267
Buruburu	Maisonette	3Br	25,000	5.5	2009	4.64	14	255,000	220
South C	Maisonette	4Br +Sq	40,000	9.0	2009	4.53	15	408,000	225
Thika	Bungalow	3br	15,000	4.5	2009	3.4	20	153,000	300
Athi River	Maisonette	3Br	25,000	6.8	2009	3.75	18	255,000	272

Source: National Housing Corporation (2009)

2.4 Regulatory and Institutional Framework for Real Estate in Kenya

The Constitution of Kenya, Section 60, sets out policy guidelines on land ownership, access and use. It recommends the establishment of a National Land Commission to supervise management of land and advice the government on appropriate policies for optimal and efficient administration of land.

The National Land Policy indicates that Kenyan land markets are concerned with transfer, lease and mortgage interests in land. It acknowledges that the land market is complex under all tenure categories and responds differently to social and economic stimuli. The market lacks adequate information, and has too many players, including the provincial administration, politicians, land owners, and 36 professionals such as valuers and lawyers. There are lengthy conveyancing processes in land markets which involve registration, taxation, valuation, mortgages, payment of stamp duties, land rents and rates. Most urban centres in Kenya suffer from land market imperfections and failures caused by poor planning, slow provisions of infrastructure and services, poor land information systems and slow land transaction procedures. The distortion in the land and property market has led to land speculation and hoarding, inefficient and corrupt administration, and has pushed the poor into the informal land markets. The policy further explains that land taxation has not reached its full potential due to land market inefficiencies caused by land speculation and under-utilization, as well as policy assessment and administrative procedures. The government proposes development and enforcement of an effective and appropriate progressive taxation system to discourage speculative hoarding of land.

Vision 2030's First Medium Term Plan 2008-2012 notes that land in Kenya is governed by many laws, most of which are in conflict and present difficulties in land administration and management. It proposes harmonization of the laws and development of a land information system for lands record management that is tenable for expeditious land transactions.

While land administration is carried out by the Ministry of Lands and Local Authorities, the Ministry of Housing is mandated to deliver on housing processes. These include development of low cost housing technologies, facilitating access to housing development finance,

promoting efficient and effective management of government housing and leases, and rent restriction and dispute resolution services for low income groups (Government of Kenya, 2004).

Despite the government's effort in land and housing provision, the demand for housing has continued to outstrip supply, particularly in urban areas. Currently, the average annual urban housing demand is estimated at 150,000 units, but only an estimated annual average supply of 30,000 to 50,000 units is expected to be produced, if the factors that constrain housing production are not addressed. The factors that constrain supply as highlighted by the National Housing Policy include: low level of investment in the sector by both public agencies and the formal private sector, with housing units produced by both sectors representing only an estimated 20 per cent of the total number of new urban households; the rapid urbanization; inaccessibility to land and housing finance; stringent planning regulations; restrictive building standards; high cost of infrastructure; poor economic performance; and increased poverty. Therefore, provision of housing requires a holistic approach from both public and private players in the market to meet the demand.

3. Review of Theoretical and Empirical Literature

3.1 Introduction

According to Capozza *et al* (2002) and Case and Shiller (2003), the price of housing is determined by the forces of supply and demand. One factor that determines demand is the population of an urban area. This is because the amount of real estate is limited, and as the population grows, the supply diminishes. Due to the increased demand, real estate prices are pushed up. Demand is also contingent upon the purchasing power of potential home owners. To gauge the purchasing power, Gross Domestic Product (GDP), inflation, Consumer Price Index, wage levels, and disposable income are used to determine what people can afford. If disposable income increases faster than inflation, demand for housing should be strong.

Supply, on the other hand, is affected by political, economic and social factors such as planning regulations, shortage of land, construction lags, and labour shortages. Thus, the low elasticity of real estate supply is more likely to cause price volatility in a real estate market. This can create a case where the price or the rents generated by the investment are either too high that they cannot be explained by the economic fundamentals (bubble) or they are inadequate to repay the mortgage of the property (burst).

According to Case and Shiller (2003), the use of 'housing bubble' is quite new and was rarely used before year 2002. The term housing boom, however, occurred more often. The term "boom" is much more neutral than "bubbles" and suggests that the rise in prices may be an opportunity for investors. In contrast, the term "bubble" connotes a negative judgment on the phenomenon, an opinion that the price levels cannot be sustained. A bubble occurs when buyers are influenced by an investment motive, they have strong expectations about future price changes in their housing markets, and they perceive little risk.

In the conventional theory of bubbles (that is rational bubble theory), real estate prices escalate beyond their fundamental values when all the investors speculate that the prices will keep going up, and a burst occurs when investors expect a collapse of the prices (Kanoh and Murase, 1999). According to Smith and Smith (2006), researchers have often focused on a single specific aspect of this general concept

such as rapid rising of prices, unrealistic expectations of future price increases, the departure of prices from fundamental value, or a large drop in prices after the bubble pops. In their study, however, Smith and Smith (2006) define a bubble as a situation in which the market price of real estate rises far above the present value of the anticipated cash flow from the asset. Thus, the central empirical question in determining whether or not a given phenomenon represents a bubble is to properly specify the economic fundamentals governing price determination.

Of major importance is the aftermath of real estate price bubbles or burst of bubbles when property prices decline. It has been noted that when the "bubble" breaks, financial institutions that lend money to land and property speculators find themselves unable to recover their loans, ending up with bad debts because the property cannot generate the income expected, triggering a collapse of the financial markets (UNESCA, u.d) .

3.2 Real Estate Speculation

Not everyone buys a house to live in it. An increasing number of property investors buy houses to try and make both capital gains and income from renting. When speculation entails constant circulation of positive stories from media, government and professionals, a boom in the economy is reinforced and prices escalate. This makes the house prices more volatile, because speculators will buy and sell as long as they are making profits. It is possible to make money during the boom and bubble period until the bubble bursts.

Foldvary (2006) noted that property speculation distorts the geographic pattern of development. With land priced for anticipated future uses rather than present-day uses, current development often shifts to lower-priced areas, where speculation has not set in. The area where development would have taken place is left less developed as the speculation turns out to be incorrect and self-defeating. Real estate speculation also induces urban sprawl, as developers skip over lands awaiting future development. The margins of urban development thus extend further than they would in the absence of market-hampering speculation.

3.3 Theoretical Literature on Speculative Property Market Bubble

According to Foldvary (2006), Henry George, the American economist and social reformer of the latter 1800s, came up with one of the first theories of business cycles that looked at property speculation. His theory highlighted that during an economic boom, at first, a growing demand for real estate is met by reducing vacancies. However, new houses are constructed and rent and land values rise. Speculators notice this and buy property expecting to sell at higher prices later. This speculative demand, added to the demand for use, carries real estate prices so high that investments in enterprise become unprofitable. Real estate becomes priced for expected future uses, rather than present-day uses, thus causing a bubble.

He further explains that the fall in new investments then reduces demand for labour and goods, which then reduces other demands, and the whole economy falls into a recession, then depression. This is what is referred to as a bubble burst. Faced with rising vacancies, real estate prices collapse, bankruptcies rise, loans default, banks fail, and then the cycle begins again.

Georgist theory, which has been coined as 'geoclassical' for emphasizing on land, was a major advance in classical thought which had not been mentioned by neoclassical economists. He predicted how long bubbles would last. Using the USA example, he noted that historically, the real-estate cycle has had duration of 18 years, aside from the interruption of World War II. He puts the next real estate bottom around 2008.

He further commented that with all the distortions caused by monetary policy and real-estate speculation and lax bank lending, the recession could be a major crash and the worst depression since the 1930s an 'economic nightmare'. He proposed that two remedies are essential: free banking and the public collection of land rent. Free-market banking would eliminate the monopolization of money and manipulation of interest rates by central banks, and leave money expansion to a competitive market of private banks. The elimination of taxes on income, sales, and produced wealth, replaced by tapping land rent for public revenue, would take the profit out of market, hampering property speculation fueled by tax-funded public works along with monetary inflation. Both reforms are necessary in order to completely eliminate the business cycle and the agony of business failures and idle workers.

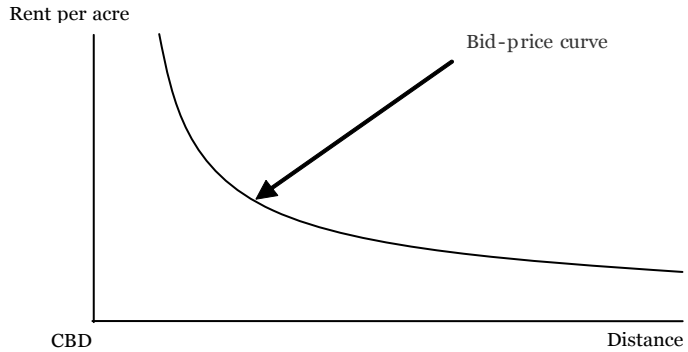
3.4 Theoretical Literature on Determinants of Land and Housing Values

According to Alonso (1964), much of the theory of land use and values is based on the works of Von Thunnen, Richardo, Alonso and Muth and draws on concepts from microeconomics. The demand by firms and households for a particular location depends upon the expected net revenue yield or utility, referred to as value. The rent is what has to be paid by a particular firm or household to prevent the site from going to another use. Since different locations have different uses and capacities, a pattern of differential rents emerges. Thus, land values and land uses are determined simultaneously by the location of the site. The greatest demand will be for those sites or locations having the greatest relative advantage. This is as shown by the bid price curve shown in Figure 3.1.

Firey (Harvey, 1996), though in agreement with Alonso, adds that there are other factors in play when determining the value of land or housing. He argues that choices of locations and land prices are influenced by social values, tastes, symbols, and social choices that will frequently vary among various social and ethnic groups of a particular society. Rational determinants of land use are contingent upon a particular culture bound value system, and the cultural component is central to location processes.

However, Harvey (1996) noted that though most writers emphasized on location, transport and culture as determinants of land values, the determination of urban land prices must incorporate accounting for multiple factors associated with the parcel of land, such as transportation mode, compatibility of land uses (planned environment), historical development of a location, topographic features, government policy, and

Figure 3.1: Determination of land prices in urban areas



Source: Alonso (1964)

globalization. He concludes that changes in local land uses and prices in a city are influenced by the location of the land unit relative to other landscape elements, and will be reflective of its uses such as commercial and residential land within the larger framework of a geographic area.

Recent studies have also suggested that models should include variables representing both the productive and consumptive values of land, by using hedonic models (Clapp and Giaccotto, 1992). These models estimate the value of real estate by decomposing it into its constituent characteristics and estimates of the contributory value of each characteristic. This information can be used to construct a price index that can be used to compare the price of real estate in different urban areas, or do time series analysis.

According to Kalra *et al* (2000), some of the salient features of the property market include: limited land supply, difficult terrain, location preferences of the population and businesses, immigration, rising wealth and a strong performing economy. Therefore, there will be movement of property prices in terms of fundamentals such as user and supplier cost factors, demographics and general economic conditions. The effect of nature conservation designation on land values will vary not only in relation to the impact on property rights, investment and income flows, but also the type of purchaser and the relative weight they place on the consumptive components of land value.

3.5 Empirical Literature on Property Bubble

Various studies have attempted to test empirically for the speculative bubbles in the market.

Garino and Sarno (2004) carried out a study to test if speculative bubbles characterized housing prices in UK using an overlapping–generations model to generate demand and two econometric techniques designed to test rational bubbles. He first tested for co-integration in a fundamental-based model using a robust estimator, and later a generalization of the Dickey-Fuller (DF) test statistic, which made use of the class of Markov regime-switching models. The variables used were real personal disposable income (log real income), the real risk-free rate (real TB rate) and the real mortgage rate. They found strong evidence of explosive, bubble type behaviour in UK house prices during the late 1980s, 1990s and early 2000.

Kalra *et al* (2000) examined the determinants of residential property prices and speculative bubbles in Hong Kong SAR during 1980-1998. Two models for property prices were applied: Univariate time series models (ARIMA models) to model the trend behaviour of the property price changes and to assess deviation of actual changes from trend values; and models motivated by the efficient markets hypothesis (EMH) (Discounted present value model) where property price changes are assumed to be determined by economic fundamentals and speculative bubbles. The latter models permit an examination of the hypothesis that property prices may be subject to speculative bubbles and allows a comparison to other models of housing markets in addition to providing a measure of the deviation of actual price changes from trend values. The variables used included residential property prices indices, rental price indices, bank lending rates (as proxy for mortgage lending rate), real interest rate, real construction index, real effective exchange rate, real GDP, real wage and population. They found that Hong Kong had speculative bubbles as those experienced in the US at the time.

Abraham and Hendershott (1996) tested empirically for bubbles in some metropolitans in the US. They expressed growth of real house prices as a linear function of the growth in real construction cost inflation, growth in real income per working age adult, growth in employment, and change in real interest rates. Though they found that prices rose by 92 per cent in three metropolitans (Boston, Nassau-Suffolk, and Newark), and various percentages in other metropolitans, the problem was distinguishing fundamental-driven house price changes and bubbles.

Kanoh and Murase (1999) investigated the theory of land price formation in Japan, taking into consideration the fact that an 'option' is implicitly attached to land. 'Option' refers to the land use that can produce optimal utilization of land. Thus, they tested various land uses on each land to get the optimal land use. They concluded that even if bubbles do not exist according to the conventional definition, there is a possibility that actual land prices exceed theoretical land prices by a large amount. This is because land owners will always be considering potential alternative uses of land. The degrees of uncertainty in their expectations play an important role in determining the option premium.

Himmelberg *et al* (2005), and Case and Shiller (1988; 2003), explained how to calculate the local annual cost of owner occupied housing and how to construct measures of home values by comparing

this cost to local incomes and rents (price-to-income ratio, and price-to-rent ratio). The measures were to assess when rapid house price increase is caused by economic fundamental factors of supply and demand and when the bubble is unsustainable bubble. They found out that these measures did not state whether or not a housing bubble exists. Instead, three insights emerged from the analysis; first, the house prices are dynamic and a local phenomenon, hence one cannot draw conclusions about house prices by comparing cities, price-to-income and price-to-rent ratios would be considered high for one city, but typical for another. Secondly, when considering local house prices, the economically relevant basis for comparison is the annual cost of ownership. Without accounting for changes in real long-term interest rates, expected inflation, expected house price appreciation and taxes, one cannot accurately assess whether houses are reasonably priced. Lastly, changes in underlying fundamentals can affect cities differently. In cities where house supply is relatively inelastic, prices will be higher relative to rent and house prices will typically be more sensitive to real long term changes in interest rates.

Ayuso and Restoy (2003) carried out a study to measure the potential of overvaluation of housing in relation to rent in Spain, UK and the US. They used the VAR models followed by GMM (Generalised Methods of Moments) to compare the three countries. They found that part of the increase in real house prices during the late 1990s was a return to equilibrium, following the undershooting of house prices after previous peaks. However, more recently, marked increases in house prices have led to price-to-rent ratios far above equilibrium in all the three countries by 2002.

Case and Shiller (1996) looked at the ratio of housing prices to household income, referring to the ratio of median house price to median family disposable income. The idea is that housing prices are a bubble waiting to burst if the buyer is priced out of the market. The method has received criticism in that affordability of a home does not tell if the price is above or below its intrinsic value, nor does the ratio of housing prices to income measure affordability.

Smith and Smith (2006), and Krainer and Wei (2004) found that housing price to rent ratio deviates over time and one should not expect the fundamental value of a home to be a constant multiple of rent. Among the many factors that affect the price-rent ratio are interest rates, growth rates, and tax laws (including property, income, and

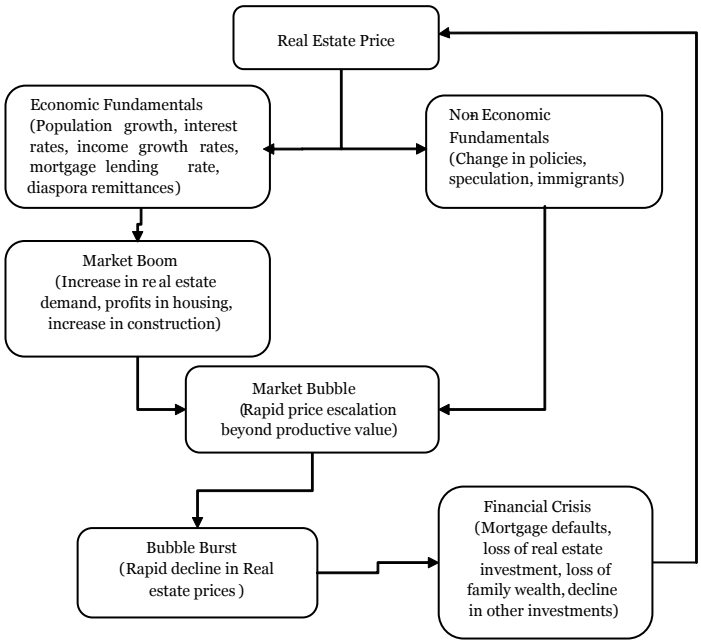
capital gain taxes). Thus, price-rent ratios in the housing market can rise without signalling a bubble if, for example, interest rates fall or the anticipated rate of growth of rent rises.

Yuelay (2004) carried out a test for housing bubbles using price-rent-ratio in China. The possible change of housing price from its fundamental value usually causes a deviation of price-rent ratio from its proper interval. The study concluded that acceptable price-rent ratio ranges from 100-250, with a benchmark of 200. The new houses were found to have a higher price-rent ratio than the old ones. When the ratio exceeds the acceptable level, it indicates that there is a bubble in the market. The results indicated that housing bubble existed in Shanghai and Hang Zhou, but found no house price bubbles in Beijing and Guangzhou.

4. Methodology

4.1 Conceptual Framework

Figure 4.1: Relationship between real estate price and other economic variables



When increase in real estate prices is determined by economic fundamentals, the prices are sustainable. It may be caused by population growth, increased diaspora remittances, availability of building and construction financial credit, and reduction in interest rates that lead to a booming market because of increase in demand for real estate. The investors make profits as they build or buy and sell the properties at higher prices. This creates confidence among the investors and speculation crops in, pushing the prices higher. This is made worse when other unexpected factors such as money laundering are injected into the market. This continues until the price reaches a point where the returns from the property are less than the value of the property, causing a real estate bubble. The phenomenon, however, creates some panic in the market and some investors withdraw. Since the supply of real estate especially houses, had increased due to demand, decrease in demand leads to decrease in price, hence a bubble burst. According to Foldvary (2006), real estate price increases cannot continue forever

if not based on economic fundamentals. After sometime, the prices decline leading to a bubble burst.

4.2 Model Specification

This study adopts Garino and Sarno (2004) methodology which employs cointegration methods to test for real estate bubbles. The method was chosen among others due to inadequate data for other methods, among them base year housing prices, housing prices for other towns for comparisons, and household incomes. For example, the use of ARIMA models by Kalra *et al* (2000) required data for various towns for comparisons, Himmelberg *et al* (2005) and Case and Shiller (1996) used household income and housing prices to assess housing affordability; Ayuso and Restoy (2003) used VAR methods to measure the potential of overvaluation of housing in various countries; while Smith and Smith (2006), and Krainer and Wei (2004) used base year prices to calculate how housing price-rent ratio deviates over time. Some of the methods have also been criticized, among them Smith and Smith (2006). It is argued that housing price-rent ratio deviation over time does not necessarily signal a bubble because it can be caused by interest rates fall or the anticipated rate of growth. Case and Shiller (1996) results were also criticized in that affordability did not indicate if the price is above or below its intrinsic value, nor does the ratio of housing prices to income measure affordability.

Garino and Sarno (2004) methodology for test of bubbles, on the other hand, is based on the assumption that a house price bubble may be thought of as an explosive component of the house price that is not present in the underlying fundamentals, and one that drives an explosive wedge between the house price and economic fundamentals. If cointegration can be established among the variables, this would indicate rejection of the hypothesis of house price bubbles. The unit root test to be employed in the empirical analysis is Dickey-Fuller test statistics.

The model for this study consists of the following variables:

HSEPRICE	Real estate prices
RGDP	Real personal disposable income (Real GDP to be used as proxy)
TBINTR	Real risk-free rate (91 day bill rate to be used as proxy)

CBLR	Commercial bank lending rates
POP-NRB	Population growth in Nairobi
BCONS	Financial credit on building and constructions
DREM	Diaspora remittances

Thus, real estate prices (HSEPRICE) is a function of the above factors, where

REPRICE =f (POP-NRB, BCONS, CBLR, TBINTR, RGDP, DREM) . (1)

If the house price and the fundamentals are realization of order one I(1), then in the absence of bubbles, the model of house prices implies cointegration between the real estate price and the fundamentals. That is, a linear combination of HSEPRICE, RGDP, TBINTR, CBLR, POP-NRB, BCONS, and DREM must exist to define a stationary process. If the real estate price contains an explosive bubble term, which is not defined in the fundamental series, then this will drive a wedge between house prices and the fundamental determinants so that cointegration between HSEPRICE, RGDP, TBINTR, CBLR, POP-NRB, BCONS, and DREM cannot be established.

Testing for cointegration involves two steps. The first step is identifying the order of integration of variables using the unit root tests. Second, estimating the cointegration regression and where cointegration is established, an error correction model (ECM) will be established.

4.2.1 Unit roots test

According to Lee (undated) and Campbell and Shiller (1988), a number of alternative tests are available for testing whether a series is stationary or not. The most commonly used are Augmented Dickey-Fuller (ADF), and Phillips and Perron (PP). In both PP and ADF unit root tests, the null hypothesis is that the series is non-stationary, and this is either accepted or rejected by examining the t-ratio. If the t-ratio is less than critical value, the null hypothesis of unit root (i.e the series is non-stationary) is accepted. If so, the first difference of the series is evaluated and if the null hypothesis is rejected, the series is considered stationary and the assumption is that the series is integrated of order one I(1) and no further differencing of the data or unit root testing is required. According to Wassell and Saunders (2005), when the sequence of the

dependent and explanatory variables are stationary at level one I(1), the classical regression model (OLS) is appropriate.

4.2.2 Cointegration test

Engle and Granger (1987) have outlined the process to test co-integration. Assuming that each series has the same number of unit roots, co-integrating regression is done. To determine if co-integration exists, any of two approaches are used. The first approach is where Durbin Watson statistic is tested to see if the residuals appear stationary. If they are non-stationary, the Durbin Watson will approach zero and, thus, the test rejects non-co-integration (finds co-integration). The second approach is when the residual sequence is stationary at level I(0). This rejects non-co-integration meaning co-integration exists.

The above procedure logically tests for bubbles in real estate prices. We first apply unit root tests to HSEPRICE, RGDP, TBINTR, CBLR, POP-NRB, BCONS, and DREM, if found stationary in order I(1), then we test for cointegration in a regression of HSEPRICE, RGDP, TBINTR, CBLR, POP-NRB, BCONS, and DREM. The real estate prices (HSEPRICE) can thus be modeled:

$$HSEPRICE = \alpha_0 + \alpha_1 POP\text{-}NRB + \alpha_2 BCONS + \alpha_3 TBINTR + \alpha_4 RGDP + \alpha_5 CBLR + \alpha_6 DREM + \varepsilon \quad \ldots\ldots(2)$$

4.3 Data

The data comprises of quarterly time series data from various institutions. The beginning of the sample period is dictated by the fact that quality real estate price series is available since 2002. The description of the data is contained in Table 4.2.

For analysis purposes, the data was transformed by taking logs except for RGDP, which was used as the original data. Annual data was converted into quarterly data using Eviews software.

Table 4.2: Original time series data

Time series	Denotation	Units	Data Spun	Source
Real Estate Prices	HSEPRICE	Ksh	2002:1-2009:4	Ministry of Lands, Crystal Valuers, Housing Finance, National Housing Corporation
Population in Nairobi	POP-NRB	Number	2002:1-2009:4	GOK, 2007 Statistical Abstract
Real gross domestic product	RGDP	%	2002:1-2009:4	GOK, 2007 Statistical Abstract
Commercial banks lending rates	CBLR	%	2002:1-2009:4	CBK (2002-2009) Time series data
Banks credit facilities to building and construction sector	BCONS	Ksh	2002:1-2009:4	CBK (2002-2009) Statistical Bulletin
91 days treasury-interest rates	TBINTR	%	2002:1-2009:4	CBK (2002-2009) Time series data
Diaspora remittances	DREM	Ksh	2002:1-2009:4	CBK (2002-2009) Diaspora remittances

Source: Author's computation

5. Empirical Results

5.1 Unit Root Tests

A unit root analysis of each of the series of the chosen variables was undertaken to ascertain the order of integration. The order of integration for all the variables must be known prior to cointegration analysis, at least to ensure that variables are not integrated of order greater than one (Engle and Granger, 1987). An augmented Dickey Fuller (ADF) unit root test was employed and the results are presented in Table 5.1.

Table 5.1: Unit root tests results

Series	Levels I(0)	First difference I(1)	lag
HSEPRICE	1.495199	-2.857658***	3
BCONS	1.380739	-2.590329**	3
POP-NRB	0.885450	-2.051897**	3
TBINTR	1.842569	--3.045842***	3
RGDP	-0.645823	-2.349529**	3
DREM	1.121427	-2.040489**	3
CBLR	-0.534555	-2.984035***	3

***<.01, **<.05 *<.10 (one tailed test) based on critical values for rejection of the hypothesis of a unit root by MacKinnon (1991)

The analysis indicated that all variables are non-stationary in levels at 1 per cent, 5 per cent and 10 per cent level of significance, but they become stationary in first difference.

Having known the order of integration, the model as specified is made to capture their effects collectively as represented on model 2. All variables, except real growth domestic product (RGDP) are in natural logarithm form because the values were too high.

5.2 Correlation Matrix

The correlation test shows that there is high correlation in most of the variables, except TB-interest rates (TBINTR) and RGDP as presented in Table 5.2.

Due to the high correlations, four models were estimated and the results are shown in Table 5.2. Model one had all the variables tested for long run relationship. Model two had all the variables except diaspora remittances (DREM), which was dropped because of high

Table 5.2: Correlation matrix

LOGHSEPRICE	LOGDREM	LOGCBLR	LOGPOP_NRB	LOGBCONS$_2$	RGDP	LOGTBINTR	
LOGHSEPRICE	1.000						
LOGDREM	0.767	1.000					
LOGCBLR	0.832	0.748	1.000				
LOGPOP_NRB	0.887	0.949	0.881	1.000			
LOGBCONS2	0.688	0.931	0.780	0.918	1.000		
RGDP	-0.735	-0.500	-0.592	-0.566	-0.288	1.000	
LOGTBINTR	0.621	0.534	0.408	0.570	0.609	-0.111	1.000

correlation with population (POP-NRB) and banks credit facilities to building and construction sector (BCONS). Model three had all the variables, except population (POP-NRB) due to its high correlation with diaspora remittances (DREM), BCONS and CBLR. The fourth model had some variables lagged and diaspora remittances (DREM) dropped. This presented the best fit and the model was adopted for analysis. The results for long-run co-integration regression are presented on Table 5.3.

Table 5.3: Long-run equations

Variable	Model 1	Model 2	Model 3	Model 4
LogPOP_NRB	2.596686*** (3.855003)	3.380189*** (8.664883)	-	-
logPOP_ NRB (-1)	-	-	-	3.385662*** (7.911507)
logCBLR	0.704621* (1.742870)	0.178964 (1.192772)	1.651891*** (3.612881)	-
logCBLR(-1)	-	-	-	0.179734 (1.329311)
RGDP	-0.009076** (-2.575077)	-0.006295** (-2.194590)	-0.009912** (-2.089330)	-0.006347** (-2.203354)
logTBINTR	0.121553*** (0.4.789842)	0.055377*** 3.139331	0.171263*** (5.395692)	0.065833*** (3.684899)
logDREM	-0.101692 (-0.538379)	-	0.356653* (0.0883)	-
logBCONS	-0.354702 (2.102572)	-0.458729*** (-4.054493)	-0.380995 (-1.674221)	-
logBCONS(-1)	-	-	-	-0.46449*** (-3.831996)
Adjusted R-squared	0.963912	0.94 9725	0.930390	0.948263
Durbin Watson	1.335654	0.933247	1.204892	0.962462

t-values are in parenthesis

***, **, * denote significance at the levels 99, 95, and 90%, respectively.

The results indicate that all the variables are highly significant in determining real estate price changes, except commercial banks lending rates (CBLR). Credit facilities to building and construction sector (BCONS) are negatively significant to real estate prices. Thus, a unit increase in BCONS has an elasticity of -0.5 to the real estate prices. The same case applies to RGDP, which was a proxy for personal disposable income. A unit increase in RGDP would lead to -0.6 per cent decrease on real estate prices. Increase in credit facilities to building and construction sector (BCONS) and RGDP increases the level of income, which can be put into buying of land, and building of houses, thus reducing the prices of real estate. This is due to the fact that as more expenditure is invested to real estate, the supply is expected to increase, hence decrease in the prices.

Population growth, on the other hand, is positively related on real estate prices. An increase of a unit in population has an elasticity of about 3.4 to the real estate prices. This is economically significant as population increases demand for real estate increases, causing an increase in real estate prices.

Commercial bank lending rates and interest rates are positively significant to real estate prices, with an elasticity of 0.2 and 0.07, respectively. Though they are statistically significant, economically, it is contrary to previous studies (Collyns and Senhadji, 2002; Geanakoplos, 2010; Garino and Sarno, 2004, Abraham and Hendershott, 1996) that found a negative relationship between interest rate and real estate prices. This reveals that changes in interest rates in Kenya do not lure peoples' decisions to take mortgages, hence when interest rates increase, the cost of money is what increases real estate prices. This is a special characteristic in the Kenyan market, which may be interpreted to mean that mortgages are not the main source of income for buying real estate. This is also unexpected in normal circumstances, indicating that other unexplained variables that are not accounted for in the model may be at play, such as money laundered in the country being used to buy real estate.

Diaspora remittances were found to be statistically insignificant, though economically significant in that an increase in one unit would lead to elasticity of -0.1 (model 1) of real estate prices. This is a new phenomenon and the data available was for a short period (2004-2009), and it is estimated with a bias resulting into inconsistent results.

Durbin Watson was also found to be lower than 2, signifying a weak positive autocorrelation (Koutsoyiannis, 1988). This may have been caused by omitted variables due to lack of data.

5.3 Testing for the Co-integration and Existence of Long Run Relationship

According to Engle and Granger (1987), long-run relationship (cointegration regression) can be modeled in the following steps. In the first step, all dynamics are ignored and co-integrating regression is estimated by the OLS. The variables should, however, be intergrated of order one I(1). In order for the variables to be cointegrated, the necessary condition is that the estimated residuals from the regression should be stationary I(0). The second step involves estimating a short-run model with error-correction mechanism (ECM) by the OLS. According to Engle and Granger (1987), if a number of variables are cointegrated, there will exist an ECM relating to variables and vice versa. This is done by running the regression with first differences of the variables and error term. One can substitute the estimated residuals from the long-run equation in place of the error correction term. According to Utkulu (2003), the estimated coefficient α in the short-run should have a negative sign and be statistically significant. The coefficient should also take a value between -1 and zero. This is regarded as convincing evidence and confirmation for the existence of stable long-run relationship and points to a long-run co-integration relationship between variables.

5.4 Residual Unit Root Test

Residual unit root test showed that co-integration existed among the variables (Table 5.3). The necessary condition is met with estimated residuals from the regression being stationary at level I(0). Therefore, ECM representation is tested. This is done by running the regression with first differences of the variables and error term (Table 5.4).

Table 5.3: Residual unit root test

Series	ADF-t-statistic	Unit root at level I(0)	Lag
Residual-ect	-4.582665	-2.653401***	3

***<.01, **<.05 *<.10 (one tailed test) based on critical values for rejection of the hypothesis of a unit root by MacKinnon (1991)

Table 5.4: Error Correction model representation test

Variable	Coefficient
dlogPOP- NRB (-1)	-9.349247 (-0.751537)
dlogCBLR(-1)	-0.016384 (0.097728)
dRGDP	-0.013365*** (-4.042908)
dlogTBINTR	0.010284 (0.607769)
dlogBCONS(-1)	-0.322751** (-2.033882)
ECM	-0.501880*** (-3.30144)
Adjusted R-squared	0.633424
Durbin Watson	0.982812

5.5 Error Correction Model Representation Test

The coefficient of the error correction model (ECM) of the selected variables is statistically significant at one per cent level, with the expected negative sign. This confirms the existence of a stable long-run relationship and points to a long-run co-integration relationship between variables (Engle and Granger, 1987). The coefficient of the ECM is around -50 in the system, implying that a deviation from the long run equilibrium following a short-run shock is corrected by about 50 per cent each quarter.

6. Conclusion and Policy Recommendations

6.1 Conclusion

Using both descriptive and econometric models, this study tested for real estate price bubbles in Nairobi Metropolitan region. The sample period (2002-2009) was dictated by the fact that quality real estate price series data was not available for a longer period.

Co-integration test rejected the hypothesis that real estate bubble existed in the Kenyan market. It established that a long-run relationship existed among the economic fundamentals. Thus, the escalation of real estate prices is influenced by economic fundamentals such as rapid population increase, concluding that the real estate price escalation in Kenya urban areas is a boom and not a bubble. Though all the factors were statistically significant, interest rate results were economically insignificant in that it was positive, which is contrary to existing literature. This reveals that changes in interest rates in Kenya do not lure peoples' decisions to take mortgages, hence when interest rates increase, the cost of money is what increases real estate prices. This is a special characteristic in Kenyan market, which may be interpreted to mean that mortgages are not the main source of income for buying real estate. This is also unexpected in normal circumstances, indicating that other unexplained variables that are not accounted for in the model may be at play such as money laundered into the country, which is used for buying real estate. Bank credits for building and construction had a negative influence on real estate prices; if more credit is availed for construction of real estate, the supply is increased, and the prices go down.

ECM confirmed the existence of stable long-run relationship and points to a long-run cointegration relationship between variables. The coefficient of the ECM implied that a deviation from the long run equilibrium following a short-run shock is corrected by about 50 per cent each quarter.

The rejection of bubble phenomenon should not, however, be taken without caution due to the constraints of data. Findings on the price-rent-ratio had indicated that some properties had price rent ratios higher than the acceptable levels of 200 to 250, especially in Westlands, Parklands and Thika. The real estate prices trend indicated drastic

price increases in 2003 and 2006, and by 2009 it was 3-5 times the price of 2003. These may be signs of a bubble formation, which could not be supported by this study. Nonetheless, the study laid the ground for further investigation into the escalation of real estate prices in the Kenyan urban market. The study proposes appropriate policy measures that would lead to sustainable real estate urban market in Kenya.

These results raise several issues for further research, among them acquisition of appropriate real estate data, dynamism of urban real estate market in Kenya, and impact of public policy on housing markets in Kenya.

6.2 Policy Recommendations

Since a real estate bubble does not exist in the Kenyan market, the following proposed policies should aim at establishing a sustainable real estate market.

6.2.1 Land banking

Land banking is a technique whereby a city, county, or non-profit organization, in anticipation of future development, acquires vacant or under-utilized land and converts it to productive use or holds it for long term strategic public purposes According to Alexander (2008), some American cities such as St. Louis, Cleveland, Louisville, Atlanta, and Flint have used land banking as a planning tool to minimize sub-urban sprawl, preserve green space, and control skyrocketing land prices. The tool also stipulates future developments that incorporate low-income housing.

The Kenya Vision 2030, Sector plan for lands 2008-2012, has noted that lack of adequate serviced land for housing in urban areas necessitates setting aside land. The National Land Policy (2009) has also recognized the importance of land banking in urban areas. Findings confirm that increased demand for real estate has led to increase in real estate prices in urban areas in Kenya. This is caused by demand for real estate, which is higher than supply within the town. This has led to urban sprawl, and inadequate low income housing which has resulted into informal and slum settlements, and expansion of town boundaries. Thus, land banking tool would be handy to control urban sprawl, informal settlements, and provision of adequate green areas. It

would also control land prices and discourage land speculation which is a main factor in price escalation in urban areas in Kenya.

6.2.2 Facilitation of affordable financial credit on building constructions

Findings reveal that increased financial credit for building and construction has a negative impact on real estate prices. Access to credit for housing purposes has been identified as a cornerstone in a sustainable housing delivery process (Vuyisani, 2004). As financial credit facilities increase, lending rates decrease due to competition by various lending organizations. This leads to high and middle income segment of the population being able to take credit to buy or build real estate for owner occupation, while investors take credit to build more houses for both rental and sale purposes. This introduces more players in the real estate market, as well as increases real estate supply. Increased supply leads to market competition and decrease in real estate prices. To cater for the low income class, the Ministry of Lands should also implement the housing policy, which aims at providing subsidized houses to civil servants and facilitate. The ministry should also regularize informal settlement so that the low income segment of the population can use land as collateral for borrowing financial credit for development of real estate.

6.2.3 Declaration of source of the money for acquisition of real estate

Contrary to the expectations of the study, interest rates and commercial lending rates were economically insignificant to real estate prices. Although this could be interpreted differently, it indicates that other unexplained or omitted variables that are not accounted for in the model may be at play in the market. Money laundering and regimes structural breaks are major variables that were not possible to capture in the model because of lack of data. The government should come up with channels to establish sources of money in acquiring real estate. This would capture, among other variables, the laundered money to the country, which is used in acquiring real estate.

6.2.4 Real estate database

Kenya lacks a comprehensive land information system, since land data is managed manually in a central registry, local authorities, provincial and district registries. This has led to land inequalities in the country with few individuals owning large chunks of land in various regions of the country (Moyi and Ronge, 2006). Land adjudication is still ongoing, and this takes a long time to be updated due to the nature of land administration. Private land and housing transactions are also not publicly declared, leading to real estate information asymmetry in the country. Professionals and mortgage lenders protect such information due to fear of competitors who can use the data against them in the market, while private transactions are not disclosed due to security reasons. Real estate data is very important especially to local authorities who raise their revenue through real estate taxation, and lack of data means less revenue is collected. The major problem in carrying out a study in real estate is lack of information. To improve on real estate data access and management, a database should be established where all real estate transactions are reported and maintained. The database should be generated by the Ministry of Lands by establishing a National Land Information System. The system should make basic land records open and readily accessible. The readily usable information can be generated and used for real estate taxation purposes, market information, as well as policy analysis.

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Appendix

Unit root tests for various variables

Order I(0)

1) Commercial Bank Lending Rates I(0)

Null Hypothesis: LOGCBLR has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-0.534555	0.4769
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGCBLR)
Method: Least Squares
Date: 04/26/10 Time: 11:15
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOGCBLR(-1)	-0.001389	0.002598	-0.534555	0.5972
D(LOGCBLR(-1))	0.521285	0.159882	3.260435	0.0029
R-squared	0.280107	Mean dependent var	-0.003260	
Adjusted R-squared	0.254397	S.D. dependent var	0.018627	
S.E. of regression	0.016084	Akaike info criterion	-5.357614	
Sum squared resid	0.007244	Schwarz criterion	-5.264200	
Log likelihood	82.36420	Hannan-Quinn criter.	-5.327730	
Durbin-Watson stat	1.859752			

2) Diaspora Remittances I(0)

Null Hypothesis: LOGDREM has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=5)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		1.121427	0.9268
Test critical values:	1% level 5% level 10% level	-2.669359 -1.956406 -1.608495	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGDREM)
Method: Least Squares
Date: 04/26/10 Time: 11:19
Sample (adjusted): 2004Q2 2009Q4
Included observations: 23 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOGDREM(-1) D(LOGDREM(-1))	0.000823 0.531310	0.000734 0.184622	1.121427 2.877831	0.2748 0.0090
R-squared	0.277116	Mean dependent var	0.011986	
Adjusted R-squared	0.242693	S.D. dependent var	0.018307	
S.E. of regression	0.015931	Akaike info criterion	-5.358111	
Sum squared resid	0.005330	Schwarz criterion	-5.259373	
Log likelihood	63.61828	Hannan-Quinn criter.	-5.333279	
Durbin-Watson stat	2.046447			

3) House prices I(0)

Null Hypothesis: LOGHSEPRICE has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.495199	0.9635
Test critical values:	1% level 5% level 10% level	-2.644302 -1.952473 -1.610211	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGHSEPRICE)
Method: Least Squares
Date: 04/26/10 Time: 11:20
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGHSEPRICE(-1) D(LOGHSEPRICE(-1))	0.000830 0.419759	0.000555 0.177274	1.495199 2.367852	0.1460 0.0250
R-squared	0.167588	Mean dependent var		0.009130
Adjusted R-squared	0.137859	S.D. dependent var		0.020152
S.E. of regression	0.018711	Akaike info criterion		-5.055040
Sum squared resid	0.009803	Schwarz criterion		-4.961627
Log likelihood	77.82561	Hannan-Quinn criter.		-5.025157
Durbin-Watson stat	1.940348			

4) Population I(0)

Null Hypothesis: LOGPOP_NRB has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		0.885450	0.8948
Test critical values:	1% level	-2.644302	
	5% level	-1.952473	
	10% level	-1.610211	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGPOP_NRB)
Method: Least Squares
Date: 04/26/10 Time: 11:21
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOGPOP_NRB(-1)	3.66E-05	4.14E-05	0.885450	0.3835
D(LOGPOP_NRB(-1))	0.937494	0.064067	14.63304	0.0000
R-squared	0.864400	Mean dependent var		0.004137
Adjusted R-squared	0.859558	S.D. dependent var		0.000263
S.E. of regression	9.84E-05	Akaike info criterion		-15.55124
Sum squared resid	2.71E-07	Schwarz criterion		-15.45783
Log likelihood	235.2686	Hannan-Quinn criter.		-15.52136
Durbin-Watson stat	2.479374			

5) Interest rates I(0)

Null Hypothesis: LOGTBINTR has a unit root
Exogenous: None
Lag Length: 6 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.842569	0.9812
Test critical values:	1% level	-2.660720	
	5% level	-1.955020	
	10% level	-1.609070	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGTBINTR)
Method: Least Squares
Date: 04/26/10 Time: 11:33
Sample (adjusted): 2003Q4 2009Q4
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGTBINTR(-1)	0.030838	0.016736	1.842569	0.0819
D(LOGTBINTR(-1))	0.039501	0.090953	0.434300	0.6692
D(LOGTBINTR(-2))	-0.021413	0.086702	-0.246975	0.8077
D(LOGTBINTR(-3))	-0.149796	0.084815	-1.766154	0.0943
D(LOGTBINTR(-4))	0.137718	0.084973	1.620732	0.1225
D(LOGTBINTR(-5))	-0.368468	0.086516	-4.258941	0.0005
D(LOGTBINTR(-6))	-0.258596	0.087549	-2.953731	0.0085
R-squared	0.682123	Mean dependent var		0.031670
Adjusted R-squared	0.576164	S.D. dependent var		0.095715
S.E. of regression	0.062313	Akaike info criterion		-2.481802
Sum squared resid	0.069892	Schwarz criterion		-2.140516
Log likelihood	38.02252	Hannan-Quinn criter.		-2.387144
Durbin-Watson stat	1.902399			

6) RGDP I(o)

Null Hypothesis: RGDP has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-0.645823	0.4290
Test critical values:	1% level 5% level 10% level	-2.644302 -1.952473 -1.610211	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 04/26/10 Time: 11:34
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
RGDP(-1) D(RGDP(-1))	-0.016814 0.659060	0.026035 0.152554	-0.645823 4.320167	0.5237 0.0002
R-squared	0.386908	Mean dependent var		0.123187
Adjusted R-squared	0.365012	S.D. dependent var		0.840666
S.E. of regression	0.669894	Akaike info criterion		2.100946
Sum squared resid	12.56523	Schwarz criterion		2.194360
Log likelihood	-29.51420	Hannan-Quinn criter.		2.130830
Durbin-Watson stat	2.076929			

7) Building and Construction I(0)

Null Hypothesis: LOGBCONS2 has a unit root
Exogenous: None
Lag Length: 1 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.380739	0.9547
Test critical values:	1% level		-2.644302
	5% level		-1.952473
	10% level		-1.610211

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGBCONS2)
Method: Least Squares
Date: 04/26/10 Time: 11:37
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGBCONS2(-1)	0.000947	0.000686	1.380739	0.1783
D(LOGBCONS2(-1))	0.523485	0.160411	3.263407	0.0029
R-squared	0.274074	Mean dependent var		0.008721
Adjusted R-squared	0.248148	S.D. dependent var		0.017111
S.E. of regression	0.014836	Akaike info criterion		-5.519117
Sum squared resid	0.006163	Schwarz criterion		-5.425703
Log likelihood	84.78675	Hannan-Quinn criter.		-5.489233
Durbin-Watson stat	2.059144			

First difference

1) Building and construction I(1)

Null Hypothesis: DLOGBCONS2 has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-2.590329	0.0114
Test critical values:	1% level		-2.644302
	5% level		-1.952473
	10% level		-1.610211

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLOGBCONS2)
Method: Least Squares
Date: 04/26/10 Time: 11:40
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
DLOGBCONS2(-1)	-0.376165	0.145219	-2.590329	0.0148
R-squared	0.187795	Mean dependent var	0.000185	
Adjusted R-squared	0.187795	S.D. dependent var	0.016718	
S.E. of regression	0.015067	Akaike info criterion	-5.519914	
Sum squared resid	0.006583	Schwarz criterion	-5.473207	
Log likelihood	83.79871	Hannan-Quinn criter.	-5.504972	
Durbin-Watson stat	2.139501			

2) Commercial banks lending rates I(1)

Null Hypothesis: D(LOGCBLR) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-2.984035	0.0042
Test critical values:	1% level		-2.644302
	5% level		-1.952473
	10% level		-1.610211

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGCBLR,2)
Method: Least Squares
Date: 04/26/10 Time: 11:43
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOGCBLR(-1))	-0.461329	0.154599	-2.984035	0.0057
R-squared	0.234367	Mean dependent var		0.000479
Adjusted R-squared	0.234367	S.D. dependent var		0.018154
S.E. of regression	0.015885	Akaike info criterion		-5.414127
Sum squared resid	0.007318	Schwarz criterion		-5.367420
Log likelihood	82.21190	Hannan-Quinn criter.		-5.399185
Durbin-Watson stat	1.873894			

4) Diaspora remittances I(1)

Null Hypothesis: D(LOGDREM) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=5)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-2.320494	0.0226
Test critical values:	1% level		-2.669359
	5% level		-1.956406
	10% level		-1.608495

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGDREM,2)
Method: Least Squares
Date: 04/26/10 Time: 11:44
Sample (adjusted): 2004Q2 2009Q4
Included observations: 23 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOGDREM(-1))	-0.343995	0.148242	-2.320494	0.0300
R-squared	0.189403	Mean dependent var		-0.001651
Adjusted R-squared	0.189403	S.D. dependent var		0.017798
S.E. of regression	0.016024	Akaike info criterion		-5.386907
Sum squared resid	0.005649	Schwarz criterion		-5.337538
Log likelihood	62.94943	Hannan-Quinn criter.		-5.374491
Durbin-Watson stat	2.198755			

5) Housing Prices I(1)

Null Hypothesis: D(LOGHSEPRICE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.857658	0.0058
Test critical values:	1% level		-2.644302
	5% level		-1.952473
	10% level		-1.610211

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGHSEPRICE,2)
Method: Least Squares
Date: 04/26/10 Time: 11:46
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOGHSEPRICE(-1))	-0.473293	0.165623	-2.857658	0.0078
R-squared	0.218908	Mean dependent var		0.000686
Adjusted R-squared	0.218908	S.D. dependent var		0.021618
S.E. of regression	0.019106	Akaike info criterion		-5.044891
Sum squared resid	0.010586	Schwarz criterion		-4.998184
Log likelihood	76.67336	Hannan-Quinn criter.		-5.029949
Durbin-Watson stat	1.996178			

6) Population I(1)

Null Hypothesis: D(LOGPOP_NRB) has a unit root
Exogenous: None
Lag Length: 4 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-2.110992	0.0357
Test critical values:	1% level		-2.656915
	5% level		-1.954414
	10% level		-1.609329

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGPOP_NRB,2)
Method: Least Squares
Date: 04/26/10 Time: 11:47
Sample (adjusted): 2003Q3 2009Q4
Included observations: 26 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOGPOP_NRB(-1))	-0.010723	0.005080	-2.110992	0.0469
D(LOGPOP_NRB(-1),2)	-0.190402	0.185320	-1.027422	0.3159
D(LOGPOP_NRB(-2),2)	-0.008090	0.189042	-0.042793	0.9663
D(LOGPOP_NRB(-3),2)	0.046063	0.188472	0.244400	0.8093
D(LOGPOP_NRB(-4),2)	-0.508901	0.184494	-2.758360	0.0118
R-squared	0.358936	Mean dependent var	-2.68E-05	
Adjusted R-squared	0.236828	S.D. dependent var	0.000105	
S.E. of regression	9.21E-05	Akaike info criterion	-15.57572	
Sum squared resid	1.78E-07	Schwarz criterion	-15.33378	
Log likelihood	207.4844	Hannan-Quinn criter.	-15.50605	
Durbin-Watson stat	2.146085			

7) RGDP I(1)

Null Hypothesis: D(RGDP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-2.349529	0.0205
Test critical values:	1% level		-2.644302
	5% level		-1.952473
	10% level		-1.610211

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares
Date: 04/26/10 Time: 11:48
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(RGDP(-1))	-0.352401	0.149988	-2.349529	0.0258
R-squared	0.158927	Mean dependent var		0.024375
Adjusted R-squared	0.158927	S.D. dependent var		0.723069
S.E. of regression	0.663127	Akaike info criterion		2.049066
Sum squared resid	12.75240	Schwarz criterion		2.095772
Log likelihood	-29.73599	Hannan-Quinn criter.		2.064008
Durbin-Watson stat	2.053523			

Model 1: Long run relationship

Dependent Variable: LOGHSEPRICE
Method: Least Squares
Date: 04/26/10 Time: 11:51
Sample (adjusted): 2003Q4 2009Q4
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	-0.009076	0.003525	-2.575077	0.0191
LOGTBINTR	0.121553	0.025377	4.789842	0.0001
LOGPOP_NRB	2.596686	0.673589	3.855003	0.0012
LOGDREM	-0.101692	0.188886	-0.538379	0.5969
LOGCBLR	0.704621	0.404288	1.742870	0.0984
LOGBCONS2	-0.354702	0.168699	-2.102572	0.0498
C	-8.740129	3.453966	-2.530462	0.0209

R-squared	0.963912	Mean dependent var	6.750933
Adjusted R-squared	0.951883	S.D. dependent var	0.078935
S.E. of regression	0.017315	Akaike info criterion	-5.043003
Sum squared resid	0.005397	Schwarz criterion	-4.701718
Log likelihood	70.03754	Hannan-Quinn criter.	-4.948345
F-statistic	80.12986	Durbin-Watson stat	1.335654
Prob(F-statistic)	0.000000		

Model 2: Long run relationship

Dependent Variable: LOGHSEPRICE
Method: Least Squares
Date: 04/27/10 Time: 08:17
Sample: 2002Q1 2009Q4
Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	-0.006295	0.002868	-2.194590	0.0373
LOGTBINTR	0.055377	0.017640	3.139331	0.0042
LOGPOP_NRB	3.380189	0.390102	8.664883	0.0000
LOGCBLR	0.178964	0.150041	1.192772	0.2437
LOGBCONS2	-0.458729	0.113141	-4.054493	0.0004
C	-13.28968	2.190527	-6.066887	0.0000
R-squared	0.949725	Mean dependent var		6.727466
Adjusted R-squared	0.940057	S.D. dependent var		0.083101
S.E. of regression	0.020346	Akaike info criterion		-4.784521
Sum squared resid	0.010763	Schwarz criterion		-4.509696
Log likelihood	82.55234	Hannan-Quinn criter.		-4.693425
F-statistic	98.23104	Durbin-Watson stat		0.933247
Prob (F-statistic)	0.000000			

Model 3: Long run relationship

Dependent Variable: LOGHSEPRICE
Method: Least Squares
Date: 04/27/10 Time: 08:47
Sample (adjusted): 2004Q1 2009Q4
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP	-0.009912	0.004744	-2.089330	0.0511
LOGTBINTR	0.171263	0.031741	5.395692	0.0000
LOGCBLR	1.651891	0.457222	3.612881	0.0020
LOGBCONS2	-0.380995	0.227566	-1.674221	0.1114
LOGDREM	0.356653	0.197917	1.802036	0.0883
C	4.479221	0.566604	7.905382	0.0000
R-squared	0.930390	Mean dependent var		6.754736
Adjusted R-squared	0.911054	S.D. dependent var		0.078257
S.E. of regression	0.023339	Akaike info criterion		-4.465041
Sum squared resid	0.009805	Schwarz criterion		-4.170528
Log likelihood	59.58049	Hannan-Quinn criter.		-4.386906
F-statistic	48.11700	Durbin-Watson stat		1.204892
Prob (F-statistic)	0.000000			

Model 4: Long run relationship

Dependent Variable: LOGHSEPRICE
Method: Least Squares
Date: 04/19/10 Time: 15:17
Sample (adjusted): 2002Q2 2009Q4
Included observations: 31 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOGPOP_NRB1	3.406720	0.375491	9.072705	0.0000
LOGCBLR1	0.192550	0.124565	1.545776	0.1347
RGDP	-0.008207	0.002422	-3.389226	0.0023
LOGTBINTR	0.055417	0.015664	3.537788	0.0016
LOGBCONS21	-0.462947	0.103786	-4.460593	0.0002
C	-13.44032	2.112122	-6.363419	0.0000
R-squared	0.954270	Mean dependent var	6.731064	
Adjusted R-squared	0.945123	S.D. dependent var	0.081901	
S.E. of regression	0.019186	Akaike info criterion	-4.897294	
Sum squared resid	0.009202	Schwarz criterion	-4.619748	
Log likelihood	81.90805	Hannan-Quinn criter.	-4.806821	
F-statistic	104.3362	Durbin-Watson stat	0.889115	
Prob (F-statistic)	0.000000			

Residual test for model 4

Null Hypothesis: RESID06 has a unit root
Exogenous: None
Lag Length: 3 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.582665	0.0001
Test critical values:	1% level 5% level 10% level	-2.653401 -1.953858 -1.609571	

*MacKinnon (1996) one-sided p-values

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID06)
Method: Least Squares
Date: 04/19/10 Time: 15:39
Sample (adjusted): 2003Q2 2009Q4
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID06(-1)	-1.190957	0.259883	-4.582665	0.0001
D(RESID06(-1))	0.729123	0.201776	3.613528	0.0015
D(RESID06(-2))	0.538435	0.203974	2.639722	0.0146
D(RESID06(-3))	0.368272	0.204989	1.796548	0.0856
R-squared	0.521513	Mean dependent var	0.000956	
Adjusted R-squared	0.459102	S.D. dependent var	0.017589	
S.E. of regression	0.012936	Akaike info criterion	-5.721600	
Sum squared resid	0.003849	Schwarz criterion	-5.529624	
Log likelihood	81.24160	Hannan-Quinn criter.	-5.664515	
Durbin-Watson stat	1.972399			

Shortrun regression for model 4

Dependent Variable: DLOGHSEPRICE
Method: Least Squares
Date: 04/19/10 Time: 16:10
Sample (adjusted): 2002Q3 2009Q4
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOGPOP_NRB1	-9.349247	12.44016	-0.751537	0.4600
DRGDP	-0.013365	0.003306	-4.042908	0.0005
DLOGTBINTR	0.010284	0.016920	0.607769	0.5493
DLOGBCONS21	-0.322751	0.158687	-2.033882	0.0537
DLOGCBLR1	-0.016384	0.167644	-0.097728	0.9230
ECM	-0.501880	0.148041	-3.390144	0.0025
C	0.052052	0.051693	1.006946	0.3244

R-squared	0.633424	Mean dependent var	0.009130
Adjusted R-squared	0.537795	S.D. dependent var	0.020152
S.E. of regression	0.013700	Akaike info criterion	-5.541828
Sum squared resid	0.004317	Schwarz criterion	-5.214882
Log likelihood	90.12743	Hannan-Quinn criter.	-5.437235
F-statistic	6.623791	Durbin-Watson stat	0.982812
Prob(F-statistic)	0.000361		

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