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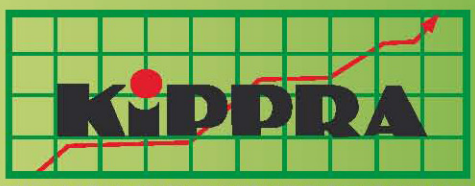

The KENYA INSTITUTE for PUBLIC
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Stimulating Supply of Residential Housing for Low Income Earners in Kenya

Gayline Vuluku

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THE KENYA INSTITUTE FOR PUBLIC POLICY
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YOUNG PROFESSIONALS (YPs) TRAINING
PROGRAMME

Stimulating Supply of Residential Housing for Low Income Earners in Kenya

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

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This paper is produced under the KIPPRA Young Professionals (YPs) programme. The programme targets young scholars from the public and private sector, who undertake an intensive one-year course on public policy research and analysis, and during which they write a research paper on a selected public policy issue, with supervision from senior researchers at the Institute.

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Abstract

The need to have shelter is indispensable to humanity and is classified among the top three basic needs. However, increase in population, scarcity of fixed assets such as land, escalating house prices, and the rising cost of living have made living inadequate and decent housing an illusion for many Kenyans. We use time series data, 1980-2011, drawn from the Kenya National Bureau of Statistics (KNBS) to determine the factors that would stimulate the residential housing market for low income earners. The Instrumental Variable estimation technique is applied for this study.

The study found that Mombasa had a minimum house price of Ksh 2.24 million. This is already above the low cost amount provided by the Housing Bill 2011 for low income earners. Nairobi, on the other hand, had a minimum cost of supply of Ksh 2.12 million. The regression results are unique for the two towns. Whereas Nairobi had the lending rate, the cost of supply, the plinth area, labour and input cost index, inflation and the real interest rate being important in determining supply, Mombasa reported the coefficient, cost of building a house, commercial bank rate and their lagged values as important factors in determining supply. Additionally, treasury bill rate and plinth area were important in explaining supply of residential housing.

In conclusion, the study recommends that while the government plays the role of an enabler, private developers should take advantage of the tax incentives to the low income segment. At the same time, they should consider offsetting profit margins with volumes of sales resulting from affordable housing. In addition, the National Housing Corporation (NHC) should devote itself to deliver low cost housing to the low income segment whose needs cannot be met by the private sector.

Abbreviations and Acronyms

CBK	Central Bank of Kenya
LCH	Low Cost Housing
GoK	Government of Kenya
GDP	Gross Domestic Product
IV	Instrumental Variable
KNBS	Kenya National Bureau of Statistics
MTEF	Medium Term Expenditure Framework
NHC	National Housing Corporation
VAT	Value Added Tax

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1. Introduction

1.1 Background and Study Context

Globally, shelter is recognized as one of human's basic needs. When housing does not take a huge portion of our income, households are able to have healthy diets, quality education for their children, and meet other needs of life (Wadrip *et al.*, 2011). Consequently, there will be improved standards of living, and increased spending leading to expansion of businesses and direct/indirect employment creation. While housing is a durable good, the ability of households to access it in an adequate and decent environment without compromising other needs has a lot of economic benefits that accrue to the citizens, business community and the government (Wood, 2004). Every government, therefore, makes an effort to ensure that the housing needs of the population are met. Usually, governments mainly focus on how to meet the housing needs of low income earners. However, much more needs to be done in order to address the increasing deficit in low cost housing supply. Unlike in the developing world, the housing sector is one of the ingredients for economic growth in the developed world.

Owning a house not only fulfills a basic need, but also forms the largest share of investment for households given its monetary value and slow depreciating nature (World Bank, 2011). This has, however become an elusive dream for majority[1] of Kenyans who cannot even afford rent in formal housing systems. As a result, most urban dwellers resort to informal settlements, which lack in construction fabric, basic infrastructure and security. While some households choose to settle far away from their places of work, they spend long hours commuting and have inadequate social infrastructure. Nevertheless, the households enjoy cheaper housing and cleaner environment. According to Giddings (2007), deteriorating living conditions are a barrier to poverty reduction and creation of employment.

In Kenya, persons earning less than a gross income of Ksh 35,000 per month are defined by the Legal Notice No. 115, VAT Remission Act of 2008, as low income earners. Some of the characteristics associated with this group include: low income levels from informal employment, poor living conditions in crowded settlements with no basic infrastructure, and informal housing systems.

In the housing sector, market failure is a common phenomenon. One of the explanations to the failure has been lack of efficient market allocation (Oxley

[1] According to Homeless International, as at 2010, 55 per cent of the Kenyan urban population lived in informal settlements with a density of 250 shanties per hectare. The slum population growth rate is estimated at 6 per cent per annum.

and Smith, 1996). Another reason is the fact that consumers act in their own self interest, sometimes leading to externalities (Maclennan, 1982). In the past, several efforts have been made to provide shelter to the low income group in Kenya. One of the site and service schemes was introduced in the early 1980s, with funding from the International Monetary Fund (IMF) to provide low income earners with housing and the accompanying infrastructure. The programme met only 10 per cent of the low income urban demand, and was often not affordable to low income earners, resulting to expansion of informal settlements in urban Kenya (United Nations, 2011). However, the approach of providing shelter changed in the late 1980s by adopting the enabling approach, because it was thought that market failure was attributed to excess government intervention. Under the enabling approach, the government is tasked with providing legal, institutional and regulatory framework, while the private sector, non-governmental organizations, and individuals produce housing units. However, lack of coordination between the government and the other players led to failure of programmes such as housing through cooperatives. For instance, between 1980 and 1999, the 418 registered cooperatives with membership of 30,000 produced only less than 1,000 registered housing units were produced (United Nations, 2011).

Worsening housing conditions motivated the need to revise the housing policy through Sessional Paper No. 3 of 2004 on National Housing Policy for Kenya, which replaced Sessional Paper No. 5 of 1969. The latter followed a strategy of aided self-help and cooperatives, while the former focuses on partnerships and participation of all stakeholders guided by their comparative advantage (National Housing Policy, 2004). The current policy recognizes the gap in supply and demand of housing, and seeks to implement strategies to encourage formal and informal private sector participation. Today, most of the objectives in the policy are yet to be met. At inception of the policy in 2004, estimated urban demand for housing was 150,000 units per annum, with a supply of 35,000 units per annum. Additionally, rural demand was estimated to be 300,000 with no supply statistics reported (National Housing Policy, 2004). Over the years, the same statistics have been used in official publications to represent the demand and supply, despite demographic shifts and natural population growth.

A study by the World Bank (2011) estimated the urban demand for housing at 250,000 to 300,000 per annum, with an annual supply of around 50,000, whereas the total demand for Kenya is projected at over 2.19 million per year in the next ten years. The same study reported house ownership to comprise 18 per cent urban residents and 82 per cent rural residents. While most of the rural residents owned their homes, most of them are reported to be lacking in appropriate construction fabric.

To further boost supply of low cost houses (LCH), more incentives were provided through Legal Notice No. 115 (that is VAT Remission Act of 2008). However, since the VAT Act of 2008 came into operation, anecdotal evidence reveals that not a single developer has benefited from the incentives therein. In the Act, first time home owners are exempted from stamp duty, but this is yet to be implemented. The completion of the Housing Bill 2011 is also meant to entice supply to this segment of the market. The bill is explicit on specifications of a low cost house, and the maximum end user price as noted earlier.

Contrary to government efforts and initiatives, a look at the supply statistics as at 2008 (Table 1.1) indicates that supply of housing is biased towards the high income group, which enjoys a 60 per cent supply surplus. The upper middle, lower middle and lower income groups suffer 15 per cent, 92 per cent and 98 per cent deficits, respectively (Government of Kenya, 2008). This is an indicator that investment in low cost housing (LCH)[2] faces a huge deficit compared to the upper market segments. Therefore, there is a great investment opportunity, especially if investors took advantage of volumes sold and short wait time in the market rather than value of supply, even if the profit margin is small.

Apart from private sector players, the government also takes part in housing production through the National Housing Corporation (NHC) established in 1965 with a mandate to implement government housing policies and programmes, while promoting low cost houses. However, the price of housing developed by the corporation is beyond the reach of low income earners. In 2012, NHC completed 488 residential units in Nairobi at a cost of Ksh 1,979.02 million (Government of Kenya, 2013). Going by this, a single unit sold at an average of Ksh 4.036 million, which is out of reach for low income earners.

Table 1.1: Supply of housing to different income groups in urban Kenya

Income Group	Production	Demand	Deficit	% Deficit
High income	12,075	3,000	9,075	60
Upper middle	16,560	22,500	-5,540	-15
Lower middle	5,175	52,500	-47,325	-92
Lower income	690	72,000	-71,310	-98

Source: Government of Kenya (2008)

[2] The Housing Bill (2011) defines a LCH as one with a minimum of two habitable rooms, a cooking area and costs not more than 200 times the prevailing statutory minimum wage (Ksh 13,674.30 during financial year 2013/2014). A LCH housing project is of not less than 20 housing units intended for low-income earners, whose production should not exceed Ksh 1.6 million and sold for not more than 30 per cent of the above construction price.

The maximum[3] loan amount low income earners can access from commercial banks is Ksh 1.2 million at 18 per cent for 15 years, and a maximum of 1.3 million from NHC at an interest rate of 13 per cent for 10 years. On the other hand, the upper limit of mortgage finance for NHC is Ksh 3 million, which is too low for the existing market prices. The repayment period (10 years) is also shorter compared to other financiers, thus calling for higher installment, consequently locking many out. Keeping in mind the current budgetary allocation of Ksh 4.5 billion against the required Ksh 7 billion (MTEF, 2012), there is need for more investment in this market segment. This is mainly informed by the importance accorded to housing by the Constitution, which makes it an issue of housing for all and not housing for effective demand.

Whereas the population is growing at a rate of 3 per cent per annum, urbanization is growing at a faster rate of 4.5 per cent per annum (Government of Kenya, 2013). As at 2008, 59 per cent of urban residents lived in single-roomed dwelling units (Government of Kenya, 2008). The ratio of housing units to population in urban areas is 6.49 against a prescribed 5, while rural Kenya reports less congestion with a ratio of 3.08 persons (Government of Kenya, 2011). It is evident that if supply of low cost housing is not accelerated, pressure will further be exerted on the already few housing resources, with market forces pushing prices beyond the reach of low income earners. Consequently, informal settlements that are lacking in adequate space, basic infrastructure and construction fabric will continue to grow.

1.2 Statement of the Problem

The supply of residential housing in Kenya has faced immense challenges since independence, with the total housing shortfall, as at the year 2012, estimated to be 2 million units (Centre for Affordable Housing Finance Africa, 2012). Despite many attempts to find ways of stimulating the supply of residential housing, especially low cost housing, the exact socio-economic constraints to supply are still not clear. As discussed in the background, several policy options put forward by the government have not met most of the intended goals. For instance, in 2004 when the population was approximately 33.7 million, the demand for housing was estimated at 450,000 per annum in both rural and urban Kenya, with no reports on the units supplied. This led to the enactment of the National Housing Policy, which aims to facilitate increased supply of housing to 150,000 units in urban areas and 300,000 units in rural areas per annum for five years.[4]

[3] From the definition of a low income earner, the gross income is Ksh 35,000 before tax. With tax and the rule that one should remain with at least a third of their income after all commitments are considered, we arrive at the maximum one can commit to a mortgage.

[4] Supply to new household formations is exempted (National Housing Policy, 2004).

However, it is estimated that only 35,000 housing units are supplied in urban areas annually. From this, only 2 per cent cater for the low income group, whose demand forms 83 per cent of the total housing units demanded (Government of Kenya, 2008). Besides, as population grows, the need for housing increases and the lives of the poor cannot be improved without proper housing (Hass Consult, 2011).

Consequently, poor living conditions directly affect the productivity of the labour force, efficiency, quality of life, health and competitiveness of cities, resulting into slower economic growth (Giddings, 2007). It is, therefore, imperative that housing production is aligned to the prevailing household income levels. The study, therefore, aims to determine the factors that would enhance supply of low cost housing by addressing the associated constraints to supply.

1.3 Research Questions

- Which economic factors are associated with inadequate supply of housing in Kenya?
- How does zoning and planning regulations affect supply of housing?
- Do location-specific factors affect supply of housing?
- How do demographic factors affect supply of housing?

1.4 Research Objectives

The main objective of this study is to find out the factors that would stimulate supply of residential low cost houses in Kenya.

The specific objectives seek to:

- Determine the economic factors that influence supply of low cost residential housing;
- Estimate how zoning and planning regulations affect housing supply;
- Examine if location affects housing supply; and
- Determine if population explains supply of housing.

1.5 Justification and Policy Relevance

It is a natural need for human beings to have a house that not only provides physical security inform of shelter, but also gives psychological satisfaction of privacy and

fulfills social needs of the human family. However, the rising cost of housing, together with the rising population and fewer employment opportunities has forced most households in Kenya to seek housing for physical shelter, irrespective of the accompanying environmental condition. Housing provided in an accessible, decent and sustainable environment is one of the goals in Kenya's Vision 2030 (Government of Kenya, 2008). In its first phase, 2008-2012, the target was to increase the production of housing units from 35,000 to over 200,000 annually. However, estimates show that only 50,000 units are produced annually (World Bank, 2011). In its manifesto, the jubilee government guaranteed all Kenyans a decent home by the year 2020, in tandem with the seventh MDG (a significant improvement in the lives of at least 100 million slum dwellers who are low income earners by 2020). Furthermore, the Constitution of Kenya recognizes decent housing as a human right. We therefore recognize the challenge that comes with meeting these policy targets, and acknowledge that if steps are not taken to cover the deficit in supply of low cost housing, a worse crisis will be faced in the future. Urban areas will be most affected due to the urbanization trend in Kenya, but rural areas are not an exception, moreso with devolved government structure.

This study, therefore, aims to inform policy on what needs to be done to meet the growing deficit in supply of housing to the low income segment, and helps to meet both the domestic and international development agenda.

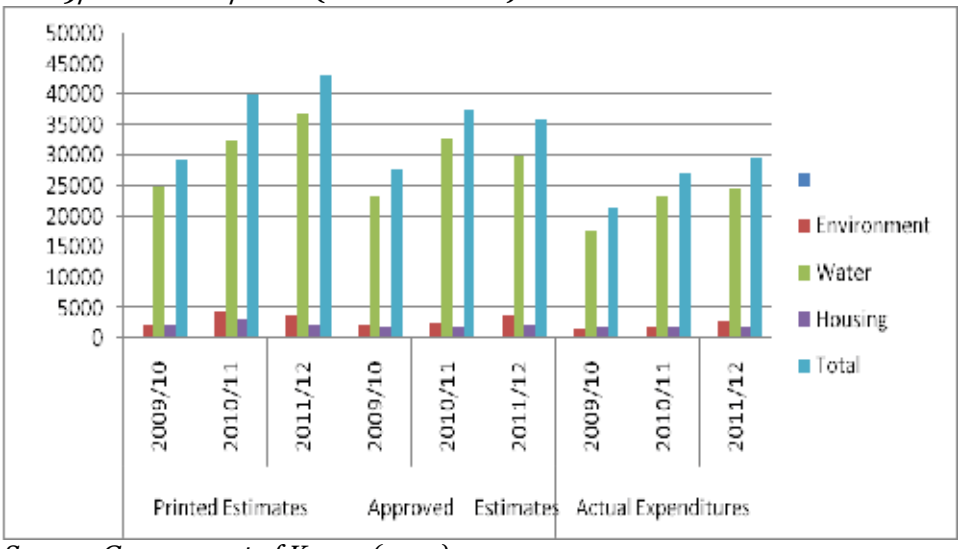
2. Literature Review

2.1 Housing Market Performance in Kenya

According to the Constitution of Kenya, it is the obligation of the government (both national and county), to facilitate and build the capacity of its citizens to access a house privately or through public housing programmes (Government of Kenya, 2010). The Government, through the exchequer, has pledged budgetary allocation towards a fund for affordable credit through the housing policy. Figure 2.1 illustrates the budget allocation against the target in the housing sub-sector for the last three financial years. From the figure, it is evident that despite inadequate allocation, the sector did not utilize its budgetary allocation fully, for the selected years, even though there is a dire need in supply of low cost housing. Housing is also given the least allocation compared to water, environment and mineral resources, despite the fact that the latter utilize much of their allocations.

Low access to funding is one of the biggest obstacles to supply of housing (World Bank, 2011). Only 2.4 per cent of the total population could afford a mortgage in 2010, with the mortgage uptake amounting to Ksh 61.4 billion against a potential Ksh 800 billion (Central Bank of Kenya and World Bank, 2010). The Central Bank of Kenya (CBK) Annual Report 2012 indicates that the value of mortgage loan assets outstanding increased from Ksh 90.4 billion in December 2011 to Ksh 122.2 billion in December 2012. Mortgage loans in the market stood

Figure 2.1: Trends of development expenditure by sub-sectors for 2009/2010-2011/2012 (Ksh millions)



Source: Government of Kenya (2012)

at 19,177 in December 2012, up from 16,029 in December 2011, with the average mortgage loan size increasing from Ksh 5.6 million in December 2011 to Ksh 6.4 million in December 2012. The increase in the average mortgage loan size is partly attributed to increased property prices. On the other hand, financial institutions face challenges in case of foreclosure, where the value of collateral is tampered by deficiencies in the resale market process and the valuation process (Central Bank of Kenya, 2012).

The high cost of construction materials, combined with difficulty in accessing land for development and expansion, has curtailed the supply of low cost housing and limited the expansion of current stocks (World Bank, 2011). According to a report by the Institute of Quantity Surveyors during the second quarter of 2013, construction cost for low income housing ranged from Ksh 28,500 to Ksh 35,500 per square metre, depending on low or high rise flat (Table 2.1). Taking an example of the minimum built area for a low cost house of 30 square metres, it would take Ksh 855,000 to construct a low cost low rise flat at the coast and western region, with central region having a highest cost at Ksh 945,000. This excludes the cost of land, which is the most expensive and scarce input.

Kenya's population has been increasing, thus exerting pressure on scarce resources such as land due to high population density. According to the 1999 National Housing and Population Census, Kenya's population was 28.7 million (Government of Kenya, 2010). In the 2009 population census, the total population had increased by 25.7 per cent over the ten-year period (Government of Kenya, 2010). A study by Green *et al.* (2005) illustrates the relationship between housing and population growth, concluding that as population and density increases, the supply of housing becomes inelastic.

Table 2.1: Construction cost (in Ksh) per square metre

Residential buildings	Central region	Coast region	Western region
High class single units (mansionettes)	40,500.00	43,500.00	43,500.00
High class high rise flats	45,500.00	43,500.00	43,500.00
Low cost low rise flats[5]	31,500.00	28,500.00	28,500.00
Low cost high rise flats[6]	35,500.00	34,500.00	34,500.00
Site and service schemes	17,500.00	19,500.00	19,500.00

Source: The Quantity Surveyor April–June 2013

[5] Few storey's with no elevator.
[6] Many storey's with elevators.

2.2 Theoretical Literature on Supply of Housing

The urban spatial theory postulates that flow of new construction is equated to growth in population. Land prices are based on the stock of housing as opposed to the level of building activity. Therefore, increased house prices initially generate huge returns, but the housing output increases temporarily above some normal level. As the stock of units increases, land prices follow suit and eventually absorb the excess returns, forcing construction to adjust downwards to its normal level (Disquale, 1994).

Secondly, the Ricardian rent theory assummes that land is fixed and a single product; say, a house is produced in the available land. Keeping in mind the fixed supply of land, demand for land is derived from the demand for housing, where the equilibrium in the market between demand and supply fixes the land price. The theory concludes that the price of land is high because the price of housing is high and not the vice versa. The neoclassical theory, on the other hand, views the production process using land as an input as the general price theory rather than income distribution. The theory proposes that land has many uses as a factor of production, and rational producers follow the most profitable use (Meen, 2001).

Thirdly, the classical price theory assumes a competitive market, where prices are determined by forces of demand and supply, with no government intervention in price determination. The quantity supplied in a market is the amount of goods that sellers are willing to produce and sell under given circumstances. They include the cost of inputs in the production process, the cost of labour, the price of capital, technology, and expectations of future prices. Supply then implies the relationship between quantity supplied and the price of the good, *ceteris paribus*. The law of supply states that when the price of a good rises and everything else remains the same, the quantity of goods supplied also rises; therefore, there is a direct relationship between supply and price.

Additionally, the quantity demanded is the total amount of goods and services buyers would choose under some conditions. Income, price of substitutes and complementary goods/services, population, preference and expectation of future prices are some of the factors that determine demand. The law of demand states that when the price of goods rises, *ceteris paribus*, the quantity of goods demanded will fall. The relationship between demand and price is thus inverse.

The housing market can therefore be conceived in the same way as the market for any other good, which is competitive in nature. A house is thus a private good to which the owners have control over. However, it can be viewed as a merit[7] good,

[7] A merit good is one which society believes individuals should have but some individuals decide not to purchase (Oxley and Smith, 1996).

which cannot be left purely to the market for ethical and political reasons (Oxley and Smith, 1996). At the same time, governments influence the housing market through policy. This is mainly because the housing market is prone to market failure, since conditions necessary for efficient market allocation do not exist as consumers act in their own interest due to effects of externalities (Maclennan, 1982). For instance, if in a neighbourhood majority of the residents build nice houses and maintain them, the perception of the locality changes irrespective of the few who did not build. Again, if houses are not well maintained in the neighbourhood, there is a negative perception by potential residents despite the few who maintain their homes, and this influences prices.

Increased output of housing units implies increased price, since price and supply have a direct relationship to suppliers due to increased effective demand by housing consumers, bringing the market back to equilibrium. If housing supply is inelastic, new construction in the market is negatively related to input price. In the housing market, inputs are combined by supply side agents to produce housing services. Relative prices may encourage producers in the housing market to increase supply or not, and suppliers of input to increase or reduce input production to this sector. Entry into the production process has few barriers with the main constraint lying in the input supply process (Mayo *et al.*, 1986). This market may not be as competitive because ownership maybe concentrated and prices fixed, for example for land market. Second, large economies of scale make production of some inputs a natural monopoly, for instance infrastructure. Finally, government regulations may restrict competitive input allocation, say finance.

The delivery of a complete housing unit to the market involves an investment of inputs by players in the production process. The inputs differ depending on taste and preferences, the size and type of a housing unit, location, variation in land use regulation, and the budget constraint. For example, a house in western Kenya may use very different materials that are context-specific and dictated by other factors such as climatic conditions, and level of security required or the purpose of the house. At the same time, a house constructed in Mombasa will have different materials used that are context-specific and unique given the prevailing conditions. Besides, developers may use different kinds of inputs depending on the target market segment and expected return on investment.

2.3 Empirical Literature on Supply of Housing

Real interest rates and expected inflation rates have a significant negative influence on new housing construction, with a huge magnitude that would not simply imply the cost of capital or holding costs, whereas cost of construction is found to have

no effect on housing starts (Topel and Rosen, 1988). To reach this conclusion, the authors use an adjustment cost model and IV estimation on a 25 year time series data of the United States. Factor prices are found to be correlated with the level of new constructions and positively correlated with relative prices of housing. Additionally, according to Disquale and Wheaton (1994), long run increase in house prices results in a permanent increase in construction, with its magnitude determined by increased factor prices caused by increase in new construction (as cited in Disquale, 1999). However, studies have found that the use of consolidated national data may not paint a true picture since regional factors may affect housing supply uniquely (Ansah, 2012; Wang *et al.*, 2012).

Mayer and Somerville (2000) did a study on the relationship between land use regulation and new residential construction using quarterly panel data from 44 metro areas. Findings suggest that land use regulation lowers the level of new constructions, with highly regulated metro areas having up to 45 per cent lower starts and price elasticity's of up to 20 per cent lower than those of less regulated areas. Whereas regulations that lengthen and delay the development process affect new construction, financial regulations have less impact on new construction. On the other hand, the cost of construction had no impact on supply of housing (Disquale and Wheaton, 1999; Muth, 1960; Phang, 2010).

A study of metropolitan specific price elasticity of supply of housing and their sources using time series data was done by Green *et al.* (2005). The authors regress population density, marginal tax rate, house price and property tax. Findings confirm that population levels, density and regulatory environment are important in explaining supply elasticity, while land use regulation leads to lower supply elasticity.

A case study of Aberdeen, United Kingdom, by Ansah (2012) modeled the supply of new residential construction for local housing markets. Using time series data, structural form model, and IV approach, housing starts are estimated as a function of changes in house price as opposed to price levels and other cost shifters to analyze their impact on price elasticity. The results indicate changes in the house price having a large positive coefficient of 3.7 per cent in the basic model, while increase in building, warrants granted, increased housing starts by approximately 0.03 per cent. Changes in raw material cost and interest rates are found to be insignificant, giving the importance of local as opposed to national housing supply measurement. Supply elasticity illustrated that developers in Aberdeen respond more to a change in house price by initiating new construction. In contrast, Kenya has been experiencing increased demand for low cost housing, but supply has remained low. It is thus paramount to establish if the market

responds to demand with more supply or higher prices, and if it is supply, to which income group.

Muth (1960) regressed the rate of housing construction on the relative price of housing, mortgage interest rate and income using national time series data spanning eight years. Estimating the reduced form model, he finds no significant relationship between price and output. Taking house price as the dependent variable regressed on housing construction, income and mortgage rate, he still finds no relationship between quantity supplied and price. This leads to the conclusion that housing supply is highly elastic. The challenge though is that new constructions take time to be delivered to the market, and therefore housing as a good cannot be highly elastic in response to market forces.

A study on determinants of price elasticity of housing supply by Wang *et al.* (2012) was carried out using panel data between 1998 and 2009 from 35 cities of China. The estimation is done using reduced form equations from the stock adjustment process to estimate price elasticity of housing and what causes the variations in elasticities. Findings indicate that the national price elasticity of housing supply in China is moderately elastic (2.8 to 5.6), but is less than that of countries with less restrictive regulatory framework. At city level, the rate of population growth, built up urban area, and regulatory restrictions determine the supply of housing in China's cities.

Grimes and Aitken (2010) did a study using panel data for 73 administrative regions in New Zealand. Using the Tobin's *q* specification, they modeled housing supply, land cost and price adjustments. The empirical results indicate that high housing supply elasticities help in containing price changes caused by housing demand shocks. The increase in land price was found to be moderate compared to the increase in house price and construction costs. The authors conclude that there is an interrelationship between supply of housing and house price dynamics.

Gross domestic product, population and real property gains tax are positively correlated with housing prices in Malaysia (Ong, 2013). Additionally, other studies in the same country have found that GDP is linked to activities in the housing market, with fluctuations in GDP having a significant relationship with house prices. While an increase in population leads to increase in the demand for housing, this in turn increases the prices of housing units. Also, the real property gains tax is inversely related to house price where the relationship is found to be significant, whereas interest rates have no significant relationship to house prices.

Increased economic activity (short term interest rates and construction cost) positively affect housing prices. Nevertheless, the adjustment process takes some years in case of a deviation from the long term equilibrium. Much as the findings

were consistent when different equations and methods were applied, variations are observed for each particular country, which can be attributed to differences at the countries' micro level characteristics. The author reached the conclusion by running a panel cointegration analysis for 15 countries over a period of 30 years, and an error correction model to determine the speed of adjustment after a shock.

Residential construction cost and region-specific factors such as demographics are found to significantly influence housing supply negatively, according to Liu and London's (2011) study on the relationship between new housing supply and residential cost with regional differences in Australia. The authors use panel data and the error correction model for their estimation. On the other hand, Tu (2000) using national and sub-national time series data found that national house price models cannot represent the sub-national price models. Thus, modeling the housing markets on a regional level without regional heterogeneities is not realistic.

Using time series data and two stages least square regression analyses, Vermeulen and Hilber (2010) did a study on the impact of restricting housing supply on house price and affordability in England. Measuring supply constraints that included availability of developable land regulation and physical restrictions, they found that regulation and physical constraints render housing markets more volatile by raising the sensitivity of prices to demand conditions. OLS results show that house prices deviate from the mean by 43 per cent, while a one standard deviation increase in developable land developed raises the house price by 2.0 per cent and elevation range affects long term volatility negatively.

2.4 Overview of Literature Review

The foregoing review indicates that most studies have focused on the factors that affect supply of housing and what determines housing prices. A lot of these studies are in the developed countries as opposed to Africa, from which the available studies are qualitative in nature. The two approaches used to empirically estimate supply constraints are the equilibrium and structural equations. The equilibrium equations have been found to have inconsistent results, especially when the time series data used is for a short period of time. Besides, using national data and reduced form equations gives unrealistic results, since housing is heterogeneous in nature, more so with regions. The cost of construction has been found to have little impact on supply of housing, with land availability/accessibility, zoning and regulatory framework being the greatest impediments to housing supply.

This study therefore aims to add on to the literature by focusing on supply of residential housing in the Kenyan context based on Nairobi and Mombasa, which are vibrant in housing development. In the end, we form a basis to inform policy on supply of housing to people of all walks of life, since it is not only a basic need but also a constitutional right.

3. Research Methods and Procedures

3.1 Analytical Framework

To estimate the relationship between housing supply and various determinants, two approaches have been used consistently. In the first approach, demand and supply of housing equations are combined into a single reduced form equation. From the equation, the price elasticity of new construction is derived from the coefficients of supply and demand shifters on the regressed reduced form equation (Muth, 1960). The second approach is the structural equation modeling approach, which directly estimates the construction in response to changes in housing price (Ansah, 2012 and Phang, 2010). New construction is modeled as a function of the level of house price and various cost shifters.

The housing market is composed of demand and supply, and the price is determined by the equilibrium condition. Let Q^s denote the quantity of housing units supplied in the reference period. P_h denotes the price of a house in the market and represents supply shifters (price index of input material cost of labour, cost of land, mortgage interest rates, cost of regulation, and cost of building permits) that affect supply of housing. The coefficients $\beta_3 \beta_2$ and β_1 measure how supply changes when supply shifters change, *ceteris paribus*. The supply function can then be represented as:

$$Q_s = \beta_o + \beta_1 C_i + \beta_2 P_h \quad \text{..... (1)}$$

If Q_s, C_i and P_h are in logarithmic form, then the coefficients measure housing supply elasticities, while the linear model has an interpretation of the coefficients as marginal effects. The assumption is that Q_s is supposed to vary for all levels of C_i and P_h. However, it is almost impossible for the supply shifters to vary exogenously, since interaction of supply and demand affect the variables. The market clearing condition states that demand and supply react to market forces to adjust back to equilibrium. We therefore introduce the demand function and specify it as:

$$Q_d = \alpha_0 + \alpha_1 P_h + \alpha_2 Y_j + \alpha_3 D_i \quad \text{..... (2)}$$

where Q_d is the number of housing units demanded, while Y_j denotes income levels (j is finite running from o to n), P_h house price, and D_i denotes population, where i is a finite number running from o to n. Whereas equation (1) is behavioural for suppliers, who could be developers or household owners, equation (2) is a behavioural relationship for home purchasers or renters. We link these two equations in our analysis because observed cost (price) of the various inputs and the final supply/demand are determined by the equilibrium condition.

$$Qs^* = Qd^* = Q^* \quad \text{.....(3)}$$

When we combine the equilibrium condition with housing supply and demand, we get:

$$Q^* = \beta_0 + \beta_1 C_i + \beta_2 P_h + \alpha_0 + \alpha_1 P_h + \alpha_2 Y_j + \alpha_3 D_i \quad \text{..... (4)}$$

Demand and supply in the market are linked through price to arrive at market equilibrium. This is represented by equation (5).

$$P_h = \frac{\alpha_0 - \beta_0}{\beta_2 - \alpha_1} + \frac{\beta_2}{\beta_2 - \alpha_1} Y_j + \frac{\beta_3}{\beta_2 - \alpha_1} C_i + \frac{\beta_4}{\beta_2 - \alpha_1} D_i \quad \text{..... (5)}$$

The assumption is that $\beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \alpha_0 \neq \alpha_1$, thus the slope of the two functions differs.

Making equation (5) stochastic, we obtain equation (6) where:

$$P_h = Z_0 + Z_{1i} C_i + Z_{2i} D_i + Z_{3j} Y_j + \varepsilon \quad \text{.....(6)}$$

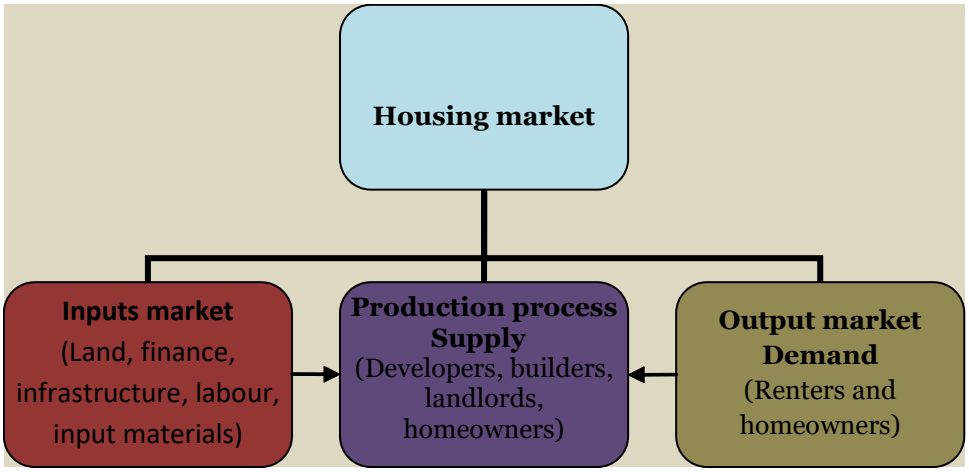
The price elasticity of housing supply is then estimated as:

$$\beta_2 = \frac{\beta_1}{Z_s} + \alpha_1 \quad \text{..... (7)}$$

The exogenous variables are assumed to be uncorrelated with the error term ε^*. Therefore, equation (5) represents housing market equilibrium; reduced form equation.

Figure 3.1 illustrates how the housing market works by combining various market players and variables linked through price.

Figure 3.1: Schematic diagram of how housing market works



Source: Mayo et al. (1986), authors representation

3.2 Model Specification

The equation to be estimated consists of the number of units supplied (SN) as an independent variable and is a function of input cost index (ICI), labour cost index (LCI), cost of capital (CBR and TBR), which is expected to be zero if capital is drawn from savings, population (POP), the total cost of supply (SC), inflation (INFLA) and plinth area (PA). We use GDP per capita to represent income and the demand side of the model. Location-specific variables, that is SC, SN, POP and PA are drawn from Mombasa and Nairobi, while the rest of the variables are nationally representative.

The number of housing units supplied to the market are allowed to vary depending on the factors that are specific to the two towns. Following Ansah (2012), we specify the housing units' completed in a given year (SN) as a function of the current and past cost of supply and other cost shifters.

$sn=f(pop,cbr,tbr,pa,sc,ici,lci,gdp,infla)$.....(8)

In the second model, we introduce the lagged variables to the three models, that is Nairobi, Mombasa, and the pooled data set and represent them as:

$sn=f(pop,cbr,tbr,pa,sc,ici,lci,gdp,infla,sct\text{-}1,ici_{t-1},infla_{t-1},cbr_{t-1},tbr_{t-1})$ .....(9)

The third model includes the lagged variable of the supply number to see if the past construction numbers affect the current supply.

$sn=f(pop,cbr,tbr,pa,sc,ici,lci,gdp,infla,sct\text{-}1,ici_{t-1},infla_{t-1},cbr_{t-1},tbr_{t-1},sn_{t-1})$..... (10)

3.3 Estimation Technique

According to Wooldridge (2009), time series data is mainly prone to non-stationarity that leads to spurious regression results. We thus test the stationarity of our variables using the Augmented Dickey Fuller approach and the Phillips Peron test. The approach makes the null hypothesis that the variable tested has a unit root. If the absolute *t* statistic is greater than the absolute critical values, we reject the null hypothesis and vice versa.

Again, we suspect possible endogeneity between the supply cost (total cost of a housing unit) and the input cost index (cost of materials used for construction) and inflation. The treasury bill rate influences the commercial bank rate and so we suspect endogeneity between them. To prove the existence/absence of endogeneity, we use the Hausman (1978) test by applying the Two Stage Residual Inclusion approach (see appendix). In the first stage, the variable suspected of

endogeneity is regressed on all exogenous variables and instruments, then the residuals are saved. The model is then estimated as specified in equation 10, including the residuals generated in each case. If the residuals are found to be significant, we then conclude presence of endogeneity.

Since we do not have instruments correlated with the said variables but not the dependent variable, we use the lagged values of endogenous variables as instruments in the model. The model is then estimated using the Instrumental Variable approach (IV), since we follow Mayer and Somerville (2000) Topel and Rosen (1988) and Ansah (2012) approach.

3.4 Data

The study uses time series data from the Kenya National Bureau of Statistics (1980-2011). The dependent variable is the number of residential building completed for private ownership in Nairobi and Mombasa (SN). Being the most vibrant towns in Kenya in terms of construction activities, we intend to use them as a sample to predict the factors affecting the market. The independent variables include: population (POP), inflation (INFLA), input cost index (ICI), supply cost (SC), plinth area (PA), commercial bank interest rate (CBR), treasury bill rate (TBR), gross domestic product per capita (GDP), and the labour cost index (LCI).

It is important to note that out of the ten variables estimated in the model, only four are specific to Nairobi and Mombasa, that is the number of housing units supplied, cost of supply, plinth area and population. The rest of the variables represent figures that are uniform for the whole country. The choice of the two towns is based on availability of data over the study period.

The number of housing units supplied to the market is defined as the volume of residential housing units completed for private ownership in a given year. This is collected from various statistical abstracts for the two towns. Plinth area is defined as the floor area occupied by the building, including wall thickness, and is presented in square metres. It serves to represent zoning land use regulations (plot ratio, ground coverage and minimum land size).

The cost of supply is presented in millions for the respective towns. The input price is an index constructed at constant prices, and is assumed to be uniform for all parts of the country. Commercial bank rate is a proxy for the mortgage interest rate, which usually has a small margin with the general lending rate in Kenya. Also, commercial bank rate is explained by the fact that it is available for the study period as opposed to the mortgage rate. We use the treasury bill rate as a proxy for the real interest rate. Due to lack of data on selling price for the housing units produced, we use the GDP per capita as a proxy for income and all demand

side factors. The assumption is based on the fact that budget constraint is what determines effective demand, and there is a causal relationship between demand and supply. Population data for the two towns is drawn from the census report for 1979, 1989, 1999 and 2009. The population for the years in between is calculated using the population growth rates reported by World Bank. Inflation variable is included to find out its effects on the total housing units supplied, since all cost shifters in the model are affected by inflation.

4. Empirical Analysis

4.1 Summary Statistics

Table 4.1 presents summary statistics of variables for residential housing completions in Nairobi. The number of housing units completed per year between 1980 and 2011 is 890, with a standard deviation of 566.67 around the mean value at an average cost of Ksh 2,610.43 million per unit. As illustrated in the table, the commercial bank rate had a mean of 18.07 per cent over the period of the study with the maximum of 45.50 per cent and a minimum of 11 per cent. On average, the treasury bill rate was at 13.46, with a standard deviation of 7.38 around the mean. This could be explained by the fact that the Treasury bill rate is risk free and remains stable compared to the commercial bank rate. The liberty enjoyed by the banks in setting interest rates could explain the huge margin in variations, together with the volatility of the financial sector and global financial challenges. The cost of supply to the market was Ksh 2,610.43 million, on average, with a minimum of Ksh 214 million reported.

The data is positively skewed. However, for GDP per capita, we observe excess kurtosis for all variables except plinth area, GDP per capita and population. This may be occasioned by the fact that some variables maybe non-stationary, but once the unit root is eliminated, the expectation is that all moments will be constant.

Table 4.2 summarizes statistics of variables for residential housing completions in Mombasa. The mean completions for the period 1980-2011 are 259.36 housing units per annum, with a standard deviation of 96.10 around the mean value. On average, the cost of supply to the market was Ksh 1,665.94 million with a minimum of Ksh 2.24 million reported. The minimum plinth area is 11 square metres against an average of 72.75 per year.

4.2 Test for Stationarity of the Data

In time series data analysis, it is important to test for stationarity of variables, since non-stationary variables lead to non-standard distribution and spurious regression results (Wooldridge, 2009). We use the Augmented Dickey Fuller and Phillips Peron test, which makes the assumption of unit root presence in the null hypothesis to test for the stationarity of our variables. The results are presented in Tables 4.1 and 4.2 for the two towns based on the location-specific variables, that is plinth area, population, supply cost and supply number. The rest of the variables remain the same irrespective of the location.

Table 4.1: Summary statistics: Nairobi

	Unit	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarquebera
SN	Number	889.79	763.00	2835.00	238.00	566.67	2.41	8.57	72.19
SC	Value	2,610.43	482.22	32,404.00	214.00	7,146.38	3.59	14.28	238.32
TBR	Percentage	13.46	13.24	39.34	1.41	7.38	1.30	6.05	21.33
CBR	Percentage	18.07	14.94	45.50	11.00	7.34	2.07	7.44	49.04
PA	Number	197.54	147.50	543.00	66.50	129.27	1.21	3.67	8.47
GDP per capita	Value	18,867.55	16,349.05	38,941.00	2,668.40	13,707.46	0.22	1.37	3.81
ICI	Index	2,681.09	2374.75	11,732.27	274.10	2,493.61	1.58	6.34	28.11
LCI	Index	2,160.40	1227.70	9,987.13	170.00	2,208.65	1.56	5.88	24.02
POP	Number	1,824,693.00	1,636,003.00	3,329,496.00	85,9230.00	755,723.20	0.43	1.99	2.35
INFLA	Percentage	10.31	9.40	41.99	0.93	7.65	2.44	10.62	109.26

Source: Author's presentation

Table 4.2: Summary statistics: Mombasa

	Unit	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
SN	Number	259.36	272.00	483.00	96.00	96.10	0.25	2.93	0.34
SC	Value	181.64	122.50	617.00	22.03	151.22	1.41	4.20	12.57
TBR	Percentage	13.46	13.24	39.34	1.41	7.38	1.30	6.05	21.33
CBR	Percentage	18.07	14.94	45.50	11.00	7.34	2.07	7.44	49.04
PA	Number	72.75	69.50	126.00	11.00	35.28	0.11	1.93	1.58
GDP	Value	18,867.55	16,349.05	38,941.00	2,668.40	13,707.46	0.22	1.37	3.81
ICI	Index	2,681.09	2,374.75	11,732.27	274.10	2,493.61	1.58	6.34	28.11
LCI	Index	2,160.40	1,227.70	9,987.13	170.00	2,208.65	1.56	5.88	24.02
POP	Number	611,759.00	570,320.60	996,577.60	354,111.00	187,365.40	0.49	2.11	2.31
INFLA	Percentage	10.31	9.40	41.99	0.93	7.65	2.44	10.62	109.26

Source: Author's presentation

Table 4.3: Augmented Dickey Fuller test

Nairobi			**Mombasa**		**Nairobi and Mombasa**	
Variable	T-Statistic	Integration Order	T-Statistic	Integration Order	T-Statistic	Integration Order
CBR	-2.7154*	(0)	-2.7154*	I (0)		
GDP	-5.0852***	(1)	-5.0852***	I (1)		
ICI	-5.5019***	(0)	-5.5019***	I (0)		
LCI	-4.9694***	(0)	-4.9694***	I (0)		
PA	-6.2987***	(1)	-6.046***	I (1)	-6.1323***	I (1)
POP	-5.8932***	(1)	-5.6364***	I (1)	-5.8980***	I (1)
SC	-6.1897***	(1)	-3.2229*	I (1)	-5.5692***	I (1)
SN	-6.6612***	(1)	-3.147**	I (0)	-5.3474***	I (1)
TBR	-3.6263**	(0)	-3.626**	I (0)		
INFLA	-3.8782**	(1)	-3.8782**	I(1)		

*(** ***) Significance levels reported at 5%, and 1%, respectively*

Table 4.4: Philip Peron test

Nairobi			**Mombasa**		**Nairobi and Mombasa**	
Variable	T-Statistic	Integration Order	T-Statistic	Integration Order	T-Statistic	Integration Order
CBR	-2.659*	(0)	-2.659*	I (0)		
GDP	-5.071***	(1)	-5.071***	I (1)		
ICI	-5.502***	(0)	-5.502***	I (0)		
LCI	-4.962***	(0)	-4.962***	I (0)		
PA	-8.2799***	(1)	-6.326***	I (1)	-6.1323***	I (1)
POP	-7.1841***	(1)	-5.704***	I (1)	-5.8980***	I (1)
SC	-5.4306***	(1)	-7.525***	I (1)	-5.5692***	I (1)
SN	-6.6612***	(1)	-3.831**	I (0)	-5.3474***	I (1)
TBR	-3.6615**	(0)	-3.661**	I (0)		
INFLA	-3.95984**	(1)	-3.959**	I (1)		

*(** ***) Significance levels reported at 5%, and 1%, respectively*

Labour cost index, input cost index, inflation, commercial bank rate, and the treasury bill rate were integrated of order zero, I (0). The number of housing units supplied (SN) in Nairobi was integrated of order 1, whereas the variable was stationary at level in Mombasa, that is I (0). The gross domestic product per capita, plinth area, population, supply cost and supply number were integrated of order one, I (1). All the variables had significance levels above 95 per cent. When we combine the two locations, four variables that change with location, plinth area, population, supply cost and supply number, are found to be integrated of order 1.

Table 4.5: Regression results for Nairobi, Mombasa and aggregate for Nairobi and Mombasa

Nairobi			**Mombasa**		**Nairobi and Mombasa**	
Variable	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
ICI	-0.8395***	-3.9756	-0.100524	-0.977937	-0.80697***	-4.4063
D(SC)	0.02482***	3.2211	0.392445**	2.044760	0.01967***	3.0514
CBR	38.17353	1.62049	-21.43844*	-1.870286	25.5852	1.2832
D(GDP)	-0.03967**	-2.1918	0.007422	0.763412	-0.02906*	-1.9548
LCI	0.92564***	3.7116	0.102631	0.854570	0.90270***	4.1611
D(PA)	-1.24701***	-2.65748	0.925157	1.298283	-0.571030	-1.5263
D(SC(-1))	-0.013148	-1.354421	0.328883*	1.987330	-0.011306	-1.3924
ICI(-1)	0.016178	0.545086	0.005807	0.408728	0.012176	0.4834
D(POP)	0.00132***	3.210664	0.003033*	1.743570	0.00074**	2.3580
TBR	-39.0179***	-4.53929	-1.225330	-0.291182	-33.8992***	-4.6562
INFLA	27.5781***	4.573809	-1.133282	-0.370395	24.98093***	4.8656
TBR(-1)	-17.24847	-0.728123	20.36057	1.663507	-18.85496	-0.9400
CBR(-1)	-2.140432	-0.295952	7.381324*	1.937965	4.382060	0.7169
INFLA(-1)	14.35554**	2.171011	5.223199	1.446557	22.14154**	3.9753
C	-95.90268	-0.588171	167.4645*	1.937735	-99.60042	-0.7128
R2	0.8664		0.5983		0.8825	
Adj. R2	0.7418		0.2234		0.7729	

*** ** * *Significance level at 1%, 5% and 10%, respectively*

4.3 Regression Results using the IV Approach

The regression analysis was carried out separately for Nairobi and Mombasa, then pooled together for the two towns to find out if location has an impact on the supply of residential housing units. The results are presented in Table 4.6, with the model explaining 86 per cent of the variations in the supply of residential housing units for Nairobi, 59 per cent for Mombasa, while the pooled data has 88 per cent explained. The intercept, which explains the supply numbers if all the explanatory variables included in the model are zero, is found unimportant in all the three models.

4.3.1 Factors that influence residential housing supply in Nairobi

From Table 4.6, the cost of supply[8] for Nairobi was found important in explaining the number of residential housing units supplied to the market, with its coefficient being significantly different from zero at 1 per cent significance level. This is contrary to findings by authors reviewed (Mayer and Somerville, 2000; Disquale and Wheaton, 1999; Muth, 1960; Phang, 2010), which could be explained by

[8] Includes the total monetary value incurred in the delivery of a housing unit.

Table 4.6: Regression results for Nairobi and Mombasa – two lag periods

	Nairobi		**Mombasa**	
Variable	Coefficient	T-statistic	Coefficient	T-statistic
ICI	-0.737773***	-3.383685	-0.070128	-0.661593
D(SC)	0.037608***	4.298283	0.107722	0.658411
CBR	33.58748***	3.675574	-3.346303	-0.740293
D(GDP)	-0.057116***	-2.686584	-0.008844	-0.900412
LCI	0.806582***	3.185486	0.082028	0.663140
D(PA)	-1.389066***	-2.733123	1.538166**	2.078266
D(SC(-2))	0.116383*	1.794085	0.189119	0.873916
ICI(-2)	0.018513	0.839087	-0.017075*	-1.767691
D(POP)	0.000988**	2.042060	0.000946	0.528698
TBR	-31.26173***	-3.577024	7.640687*	1.928608
INFLA	21.72041***	2.883787	-4.688031	-1.484248
TBR(-2)	3.353513	0.377529	-7.158240	-1.638159
CBR(-2)	4.448147	0.602984	6.505242*	1.811242
INFLA(-2)	-12.03675*	-1.708178	9.390020***	3.040076
C	-179.7555	-0.938366	180.7805**	2.222464
R^2	0.8424		0.6838	
Adj. R^2	0.6849		0.3677	

****, **, * Significance level at 1%, 5% and 10% respectively*

the context of the studies, that is mainly European economies. Unlike the local market, which experiences high cost of capital as indicated by commercial bank interest rates and the low access to financial services, the cost of capital is lower in European nations.

The treasury bill rate is observed as important in explaining the volumes of supply to the market. This implies that the real cost of capital influences the decision to supply, and this is inversely related to the number of housing units supplied. If the real cost of capital was not so high, we expect to see more residential houses in the market. Additionally, the commercial bank rate is found to be important in explaining the residential supply market. This is contrary to a study by the World Bank and Central Bank of Kenya on mortgage finance in Kenya, where the source of funds for real estate market in Kenya could not be attributed to the mortgage loan book. We can therefore conclude that those firms/people who qualify to get mortgages make maximum use of the service, and transmit the cost to the end user whether through renting or selling.

[9] This refers to all the materials used in the construction process. Refer to KNBS Statistical Abstract, building and construction chapter.

Input cost[9] index and labour cost index are important in explaining supply of residential housing. Besides being statistically significant, the input cost index is economically important in explaining the residential housing units supplied to the market. The relationship is inverse, implying that if the input cost is high then we expect lesser units in the market and vice versa. Assuming the standard inputs used in the construction process are of the same quality, for instance cement, sand, bricks or machine cut stones, we expect the cost of input material to be the same, irrespective of the market segment one is building for. The difference may come in the fittings and accessories, which are only a fraction of the input cost index. This, therefore, implies that irrespective of the supply market, cost is important in determining supply and so the same applies to low cost housing. Inflation rate is significantly different from zero at one per cent significance level. This is consistent with input and labour cost indexes as well as supply cost, which are directly affected by inflation.

GDP per capita, which the study uses as a proxy for income, is observed as important in explaining the supply of residential housing. The finding is consistent with other studies (Ong, 2013) and economic theory, where consumption of goods is limited by the budget constraint, and so is housing. The population level is found to be important in explaining the supply numbers. This may be informed by the fact that housing construction is intended for a target population and therefore this number affects supply. Finally, plinth area has a coefficient inversely related to the numbers supplied, implying that if the plinth area increases, fewer units will be supplied in the market. Again, the variable is significantly different from zero in explaining the housing units supplied to the market. Thus, zoning regulations that dictate the minimum land size, plot ratio and ground coverage for housing construction are important in explaining supply to the market.

4.3.2 Factors that influence residential housing supply in Mombasa

The regression results for Mombasa are observed to be statistically different from those of Nairobi. In the first model, with one lag period, supply cost and its lagged variable, commercial bank rate and its lagged value, and population were found to be important in explaining residential housing supply. At the same time, the constant is found to be statistically significant and it is important in explaining the supply of residential housing. This implies that there are variables that are important in explaining the housing market in Mombasa, but were not measured in this study. Some of the variables may include the regulatory and institutional framework, and the geographical attributes that were beyond the scope of the study due to data availability.

Additionally, other cost shifters such as treasury bill rate, input cost index, and labour cost index were not important in explaining supply of housing units

in Mombasa, contrary to the findings in Nairobi. The same results are reflected in the importance of inflation in influencing the market. According to the Quantity Surveyor Journal (October–December 2013), the input material costs for Mombasa are observed to be significantly lower than those of Nairobi. The location-specific endowments may explain the significant differences between the two towns. Besides, the education levels for residents have been reported to be low, coupled with high unemployment rates (Government of Kenya, 2010) and so it may be easy to access cheap menial labour and lower the construction cost significantly.

4.3.3 Two lag periods included for endogenous variables

Table 4.6 indicates the factors that were found to influence supply of housing units when the endogenous variables were lagged for two time periods. To begin with, the results for Nairobi only change marginally with the commercial bank rate and the lagged supply cost observed to be important in explaining residential housing supply as well. However, the R-squared is observed to be lower, implying that the model is best fit with one lag period; 86 per cent to 84 per cent.

Contrary, the results for Mombasa are dependent on the lag period. While supply cost and commercial bank rate together with their lagged values and population are important in explaining the supply of residential housing with only one lag, lagging the endogenous variables twice indicates that plinth area, input cost index, treasury bill rate inflation, and the constant are important in explaining supply of residential housing. Besides, the R-squared increases from 59 per cent to 68 per cent.

Plinth area was, however, found to be important in explaining the housing units supplied to the market in both towns. This is an indicator that the zoning regulations, which stipulate the ground coverage, plot ratio and minimum land sub-division, are important. Whereas the Housing Act 2011 stipulates the minimum plinth area of 30 square metres, a revision may be necessary to meet the market realities and zoning regulations that allow for more floor areas adopted.

From these findings, the study concludes that land plays a major role in stimulating supply of housing as observed by Follain (1979). At the same time, inflation and the cost of capital are factors considered by developers in making investment decisions.

4.3.4 Aggregate data: Nairobi and Mombasa

When the datasets for the two locations are combined, the results are very close to those of Nairobi. The commercial bank rate, treasury bill rate, supply cost, input and labour cost index are all important in explaining the supply of residential

housing, with their coefficients significantly different from zero. However, the plinth area, which is important for the two towns, independently becomes less important when the data is pooled. This may be explained by the fact that the pooled data leads to increased number of units with a higher magnitude compared to changes in the plinth area figures and so the effect fizzles out. On the other hand, the lagged supply cost is important in explaining the housing units supplied, meaning that on the national level, most suppliers make their expectations based on history.

Therefore, we conclude that location is important in explaining the number of residential housing units in the market. Additionally, labour costs also determine how much is availed in the market as well as the material input cost. Lastly, the cost of capital, represented by treasury bill rate and commercial banks lending rates, has a significant influence to the residential housing supply market.

4.3.4 Lagged dependent variable included in the model

Results in Table 4.7 include the lagged dependent variable and supply number

Table 4.7: Regression results for Nairobi, Mombasa and an aggregate for both cities with the dependent lagged variable included

	Nairobi		**Mombasa**		**Nairobi and Mombasa**	
Variable	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
ICI	-0.8471***	-4.060957	-0.108042	-0.920845	-0.7982***	-4.226667
D(SC)	0.0308***	3.364046	0.088941	0.531357	0.0222**	2.607805
CBR	37.21177	1.598945	-4.051276	-0.868871	24.6061	1.196385
D(GDP)	-0.0424**	-2.353115	-0.003253	-0.267749	-0.0310*	-1.964398
LCI	0.9498***	3.844179	0.125386	0.918733	0.8973**	4.024134
D(PA)	-1.2184**	-2.626406	1.504827*	2.004035	-0.5681	-1.479324
D(SC(-1))	-0.010627	-1.082135	0.186281	0.849638	-0.0097	-1.087798
ICI(-1)	0.017051	0.581709	-0.021044*	-1.919014	0.0129	0.500490
D(POP)	0.0012***	2.950535	0.001712	0.835683	0.0007**	2.281557
TBR	-28.64672	-2.342424	9.883156*	2.020366	-31.257***	-3.376184
INFLA	25.818***	4.206489	-5.956218	-1.668767	24.8520***	4.709268
TBR(-1)	-20.98044	-0.888903	-6.530620	-1.452798	-18.99964	-0.922662
CBR(-1)	-3.083060	-0.429067	6.745244*	1.847710	3.886645	0.611312
INFLA(-1)	13.6020**	2.073505	10.00491***	3.105633	21.8679***	3.806031
D(SN(-1))	-0.250797	-1.177818	-0.282443	-0.801758	-0.0919	-0.483367
C	-146.3933	-0.878726	224.9474*	2.269482	-113.1855	-0.774390
R^2	0.8785		0.6987		0.8845	
Adj. R^2	0.7483		0.3511		0.7607	

*** ** * Significance level at 1%, 5% and 10%, respectively

to analyze whether past output affects the current number of residential housing units produced.

The results show that past housing units completed do not explain current housing units supplied to the market in both towns when regressed separately. Additionally, the lagged number of units supplied is not important when the data for the two towns is pooled. This could be explained by the fact that there could be many housing units supplied to the market each year, which are consumed on delivery. At the same time, new demand arises from the ever increasing population and new household formations. Besides, if households are the builders, we expect this to be a one-off activity by them.

Again, we notice that depending on the location, variables behave uniquely. Consistent with the regression results without the lagged variable, the commercial lending rate, the cost of supply, input cost index, labour cost index, inflation and population at levels are important in explaining supply for Nairobi and the pooled data as opposed to Mombasa where these are not important. Whereas the plinth area remains important for the independent models only, emphasis is on the role played by zoning regulation in influencing the residential housing units supplied at the local level.

5. Summary, Conclusion and Policy Recommendations

5.1 Summary and Conclusions

The need to have a place to call home is indispensable to humanity, and is classified as one of the top three basic needs. However, increase in population, scarcity of fixed assets sucxh as land, and the rising cost of living have made living inadequate and decent housing an illusion to many Kenyans. It is not only expensive to build or buy but even the rental charges have been on the rise. As a result, over 80 per cent of residents in urban Kenya live in informal settlements that lack in sanitation, space, basic infrastructure and waste disposal system (World Bank, 2011). This study sought to find ways of stimulating the supply of residential housing to low income earners in Kenya.

The findings suggest that depending on the location, the factors that affect supply of housing differ. However, the plinth area and cost of capital, treasury bill rate or commercial lending rate are consistently important in explaining the number of units supplied to the market for the sample towns of Mombasa and Nairobi. The study thus concludes that the land size on which the house sits is an aspect that can be used to change the entire housing market for better. At the same time, the target population for residential housing development plays an important role in determining supply. In addition, the cost of capital represented by the treasury bill rate and commercial lending rate is important in explaining the housing market. This affirms the fact that a housing unit, in most cases, forms the largest investment for households and requires huge capital investment. Many a times, households end up borrowing to finance the investment, thus the importance of the cost of capital. For Nairobi and the aggregate dataset, besides the plinth area, GDP per capita and treasury bill rate, the study finds the supply cost, commercial banks' lending rate, input cost index, labour cost index and inflation to be important in explaining the supply of housing units delivered to the market.

In Mombasa, the input and labour cost index are found not to be important in explaining supply of housing. One of the reasons could be the fact that most inputs used in the construction industry are cheaper as opposed to Nairobi (the Quantity Surveyor April–June 2013).

Population levels were also found to be statistically significant. However, the lagged population variable was not important in all the models. The samples having been picked from urban areas, the explanation could be found in the fact that most urban residents share living units, more so in low income residential estates to reduce the cost incurred in housing, hence overcrowding. Another explanation could be that construction of most housing units is not reported, or

home builders do not get building permits, and therefore transactions are never registered with the public authorities and are not captured in the statistics.

5.2 Policy Recommendations

The cost of credit available for housing should be made more affordable by reducing the margin between the central bank rate and the commercial bank lending rate. This is driven by the fact that both the real interest rate and the commercial bank lending rate were inversely statistically important in explaining residential housing supply.

The building blocks for housing development include land, capital and the market. To begin with, land requires a significant amount of capital. At the same time, most developers would need to borrow at a cost which goes further to increasing the capital requirement. Second, the market, which includes buyers and/or tenants, needs large sums of money for purchase or significant amounts periodically for lease. In case of purchase, most buyers then have to borrow to finance acquisition.

To ease this burden, the government should put in place partnerships between companies and financial institutions to finance low cost housing for employees. For instance, if a new company is coming up, one of the requirements should be such an arrangement. This can be emulated from Safaricom Limited, which has such an arrangement in place, and the Judiciary of Kenya, which has an arrangement with the Kenya Commercial Bank as an administrator of their funds from which mortgages are awarded at 3 per cent per annum.

The cost of building materials should also be subsidized, especially to the low income segment. The study found that except for Mombasa, all the cost shifters had a very high level of statistical importance in explaining the supply market. However, for a few, most inputs used in the input cost index are imported from other countries or other towns in Kenya. It thus translates to higher costs of inputs, which end up pushing the housing prices higher.

The government should thus encourage the use of readily available alternative building material aside from the conventional, while not compromising on quality. Awareness creation about the same should be enhanced through advertisements, documentaries, social media and all other means available to disseminate the information. Households may not be aware about other innovative and cheaper alternative building materials, where and how to get them, and at what cost. This could be explained by the fact that most developers/home builders use the conventional materials, which are expensive.

There is need to actualize the incentives in the VAT Act of 2008 to those who supply to the low income market. This will result in the overall reduction of the supply cost, which translates to lower end user pricing. Most developers have not embraced these incentives due to the requirements that accompany them. For instance, the minimum plinth area of 30 square metres has been termed too ambitious, given that land as an input requires significant financial capital. In addition, factors such as one has to fix house prices at not more than 30 per cent of the construction cost and it cannot be more than 200 times the minimum wage, have acted as a deterrent to developers. Stamp duty waiver on first time owners should also be implemented in accordance to Legal Notice No. 115 of 2008. For instance, if one buys a home in Thika at a cost of Ksh 2,200,000, two per cent of this value will be paid as stamp duty, that is Ksh 88,000. If the incentive is actualized, they could use the amount for other economic activities.

Since plinth area was found to be important in determining supply, there is need to promote public private partnerships to allow affordable end user pricing. The government could supply land and then leave the private investor to put up the structures. At the planning stage in urban areas, counties should adopt mixed land use where proximity to social facilities, place of work and means of transport is considered. This would aid in reducing the escalating land prices as indicated by the importance of plinth area. The county governments, which are in the nascent stages of development, should consider proper land use planning from the onset, to delineate and preserve public land for housing development. Together with forming land banks, land use planning would help the public sector with instruments to influence the housing market positively for low cost housing.

Housing statistics should be timely, nationally representative and credible. The Kenya National Bureau of Statistics (KNBS) reports specific housing characteristics such as number of rooms, cost with respect to the various room categories, plinth area, source of funds and its cost. Take an example of housing data for Nairobi, the number of rooms are considered but without the corresponding cost, which makes it incomplete and impossible to analyze the building permits approved, which are reported without the corresponding permits applied for. It would be much easier to analyze the market if these details are included in the form filled by developers monthly and the scope of collection expanded to the 47 counties. At the same time, adoption of a digital platform to submit data should be embraced. The form should be revised to capture more details and uploaded on the KNBS website from where developers can log in, fill it and submit periodically.

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Appendix

Two Stage Residual Inclusion Estimates

Commercial bank rate

Dependent Variable: D(SN)

Method: Least Squares

Date: 05/02/14 Time: 09:33

Sample (adjusted): 3 32

Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ICI	3.914574	1.85E-11	2.12E+11	0.0000
D(SC)	0.405742	4.45E-12	9.12E+10	0.0000
CBR	-224.6727	1.04E-09	-2.17E+11	0.0000
D(GDP)	0.183245	9.08E-13	2.02E+11	0.0000
LCI	-4.527117	2.14E-11	-2.11E+11	0.0000
D(PA)	-11.35684	6.55E-11	-1.73E+11	0.0000
D(SC(-1))	0.873990	5.21E-12	1.68E+11	0.0000
ICI(-1)	0.048446	3.68E-13	1.31E+11	0.0000
D(POP)	-0.004511	4.15E-14	-1.09E+11	0.0000
INFLA(-1)	-8.40E-11	8.08E-11	-1.040556	0.3157
TBR(-1)	-6.23E-11	2.66E-10	-0.234225	0.8182
CBR(-1)	-4.04E-11	8.32E-11	-0.485628	0.6347
TBR	41.65512	1.97E-10	2.11E+11	0.0000
INFLA	-41.18037	1.97E-10	-2.09E+11	0.0000
ECBR	224.6727	1.04E-09	2.17E+11	0.0000
C	2997.405	1.41E-08	2.13E+11	0.0000
R-squared	1.000000	Mean dependent var	0.400000	
Adjusted R-squared	1.000000	S.D. dependent var	115.6632	
S.E. of regression	1.89E-09	Akaike info criterion	-37.02747	
Sum squared resid	5.02E-17	Schwarz criterion	-36.28016	
Log likelihood	571.4120	F-statistic	7.22E+21	
Durbin-Watson stat	2.846588	Prob(F-statistic)	0.000000	

Dependent Variable: D(SN)

Method: Least Squares

Date: 05/02/14 Time: 09:34

Sample (adjusted): 3 32

Included observations: 30 after adjustments

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ICI	-9.121116	2.31E-10	-3.95E+10	0.0000
D(SC)	-3.123779	8.45E-11	-3.70E+10	0.0000
CBR	227.3641	6.12E-09	3.72E+10	0.0000
D(GDP)	-0.106742	2.76E-12	-3.86E+10	0.0000
LCI	10.54538	2.67E-10	3.95E+10	0.0000
D(PA)	27.10402	6.34E-10	4.28E+10	0.0000
D(SC(-1))	-0.890737	3.12E-11	-2.85E+10	0.0000
ICI(-1)	-0.081109	2.77E-12	-2.93E+10	0.0000
D(POP)	-0.003142	2.17E-13	-1.45E+10	0.0000
INFLA(-1)	-3.81E-10	4.46E-10	-0.853961	0.4075
TBR(-1)	-2.66E-10	1.47E-09	-0.181159	0.8588
CBR(-1)	-1.88E-10	4.60E-10	-0.408725	0.6889
TBR	0.619968	5.11E-10	1.21E+09	0.0000
INFLA	121.5628	3.14E-09	3.87E+10	0.0000
EICI	9.121116	2.32E-10	3.93E+10	0.0000
C	-3268.140	8.32E-08	-3.93E+10	0.0000
R-squared	1.000000	Mean dependent var	0.400000	
Adjusted R-squared	1.000000	S.D. dependent var	115.6632	
S.E. of regression	1.05E-08	Akaike info criterion	-33.60867	
Sum squared resid	1.53E-15	Schwarz criterion	-32.86136	
Log likelihood	520.1300	F-statistic	2.36E+20	
Durbin-Watson stat	2.891439	Prob(F-statistic)	0.000000	

Dependent Variable: D(SN)

Method: Least Squares

Date: 05/02/14 Time: 09:34

Sample (adjusted): 3 32

Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ICI	0.823507	3.02E-13	2.73E+12	0.0000
D(SC)	8.241168	2.45E-12	3.37E+12	0.0000
CBR	-6.212606	1.60E-11	-3.87E+11	0.0000
D(GDP)	0.025060	1.68E-14	1.49E+12	0.0000
LCI	-1.130501	3.98E-13	-2.84E+12	0.0000
D(PA)	-2.085535	1.68E-12	-1.24E+12	0.0000
D(SC(-1))	1.830592	5.76E-13	3.18E+12	0.0000
ICI(-1)	-0.096973	3.62E-14	-2.68E+12	0.0000
D(POP)	0.044176	1.36E-14	3.25E+12	0.0000
INFLA(-1)	-6.86E-12	5.21E-12	-1.315869	0.2094
TBR(-1)	-4.51E-12	1.71E-11	-0.262891	0.7965
CBR(-1)	-3.02E-12	5.36E-12	-0.563263	0.5822
TBR	-50.49831	1.72E-11	-2.94E+12	0.0000
INFLA	-10.13438	5.07E-12	-2.00E+12	0.0000
ESC	-8.241168	2.45E-12	-3.36E+12	0.0000
C	299.7260	1.56E-10	1.93E+12	0.0000
R-squared	1.000000	Mean dependent var	0.400000	
Adjusted R-squared	1.000000	S.D. dependent var	115.6632	
S.E. of regression	1.22E-10	Akaike info criterion	-42.50950	
Sum squared resid	2.09E-19	Schwarz criterion	-41.76220	
Log likelihood	653.6426	F-statistic	1.73E+24	
Durbin-Watson stat	2.657279	Prob(F-statistic)	0.000000	

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