IREBS Foundation for African Real Estate Research

IREBS Foundation for African Real Estate Research - Am Schwarzenstein 30 - D 65366 Geisenheim - Germany
Phone: +49 (0) 69 24 00 08 40 - Fax: +49 (0) 69 24 00 08 49 - Mail: info@afrer.org - Web: www.afrer.org

Examination of the Determinants of Housing Values in Urban Ghana and Implications for Policy Makers

Anthony Owusu-Ansah

Paper presented at the African Real Estate Society Conference in Accra, Ghana from 24 -27 October 2012

Abstract: This paper employs the hedonic pricing model to analyse the impact of housing characteristics on residential property values in Kumasi, Ghana, over a six-year period, and analyse the impact of the findings on property rating in Ghana. It is established from the analysis that: the number of rooms, floors, and property age; location of the property; availability of garage, fence wall and swimming pool; and land registration; all influence residential property values in urban Ghana, with the residential class where the property is located having the greatest impact. Employing the Chow Test, the results show that the implicit prices of the housing characteristics are constant over time, so it is justified to pool the data together. Over the six-year period, there has been about 49% increment in property values in Kumasi. The paper provides useful insights regarding the determinants of residential property values in the housing market of urban Ghana – these are very relevant to market participants and professionals in the market. It has also questioned the use of the replacement cost method as the basis of property rating in Ghana since it ignores the value of land on which the property is situated.

1. Introduction

The importance of the real estate to the socio-economic development of every nation is well documented. Land, for example, is a primary commodity that provides space for human and economic activities and is seen as the sources of wealth and power (Abdulai, 2010). Therefore, it is not surprising that in many countries in the developing world, landed property accounts for about 50% to 75% of the national wealth (Bell, 2006). Real estate forms a major source of revenue for especially local governments in the form of property taxation. In Ghana, property rate alone forms about 60% of local governments' revenues.

Housing is one of the most important sub-sectors of the real estate industry. Liu et al. (2002) for instance indicate that out of the various aspects of real estate development in China, commercial housing investment is the largest and the most important. The sub-sector serves as a critical element of households' portfolio. Thus, awareness of its value or price is crucial to the owner, investors and other decision makers. It is partly because of the above that housing plays an important role in mortgage transactions - financial institutions are often willing to grant loans relying on the mortgagor's house or real estate as generally as collateral.

Housing also, constitutes an important component of the real wealth of people who own it. When there is an appreciation of the value of housing, it translates into increases in the real wealth of owners. There is therefore the need to be aware of the value of the real estate concerned. Various studies including Green (1997), Coulson and Kim (2000), Chau and Zou (2000), Wen (2001), Liu et al. (2002), Leung (2003), etc have also established the effects of housing investment on a country's economic growth. These studies note that housing investment may stimulate GDP growth more than other types of investment.

Housing is a composite and a very heterogeneous commodity. A lot of macro-economic variables, spatial differences, characteristics of community structure, the environment and neighbourhood amenities affect the housing market (Kim and Park, 2005). Establishing the relationships that exist between residential property values and these physical and locational housing attributes, amenities etc, are very important to valuers, planning authorities and policy makers. For example, when these relationships are established, valuers will be aided accordingly when assigning premium of values to the various housing and locational characteristics. As a result of this, a lot of studies have been conducted to investigate the relationship that exists between housing prices (values) and housing characteristics. However, such studies are conducted in different locations and geographical regions and so the impact

of housing attributes on the price of the property may be different at different geographical regions (Sirmans et al., 2005). Thus, the effect of the housing attributes on house prices relate to particular housing markets or geographical locations and, therefore, it would be unsustainable to argue that a generalisation can be made regarding the effect of housing attributes on house prices.

In the developed housing markets like the USA and UK, a lot of studies have been undertaken to examine the relationship between house prices and housing attributes (see for example, Zietz et al., 2008; Sirmans et al., 2005; Kiel and Boyle, 2001; Benson et al., 1998; Ball, (1973); Grether and Mieszkowski, 1974). In the developing markets also, the use of the hedonic price model to examine housing market dynamics has been very encouraging, with some of the studies coming from Latin America and Asia. Pasha and Butt (1996) for instance empirically analyse the demand for housing attributes in Pakistan by using the hedonic method and among other things find plot size, living space, number of rooms occupied by the house, number of bathrooms in a house and quality indicators to influence house prices in Pakistan.

In Africa also, the application of the hedonic pricing model has had its fair share with most of the studies coming from Nigeria in the West of Africa. Megbolugbe (1986) empirically examines housing trait prices using the hedonic price function and the Box-Cox functional form procedure. Among other things, he finds the means of water supply to the house, nature of road system in a neighbourhood, availability of essential facilities in accommodation, building gross area, number of floors and number of rooms in a building to affect the price one pays for a house in the city of Jos in Nigeria. Arimah (1992a) also estimates the demand for a set of housing characteristics using data from Ibadan, Nigeria. There are a lot of other Nigerian studies with the use of the hedonic pricing model (see for example Bello and Bello, 2008; Bello, 2000; Arimah, 1992b; Megbolugbe, 1991, 1989; etc).

In Ghana however, not much has been done with regards to the application of the hedonic pricing model to examine the relationship existing between house prices and housing attributes as compared to in Nigeria for instance. One of the few studies that have been found to empirically examine the factors that influence land values in Ghana is the study by Asabere (1981). Asabere (1981) examines the determinants of land values in Accra, the capital city of Ghana, but without consideration to property characteristics. Among other things, he finds the availability of schools and hospitals, and distance to the CBD and the sea, to influence land values in Accra. In the other cities of Ghana, no study has been found and so the relationship between property values and housing attributes is left unexplained. Finding evidence about this relationship will however guide estate agents and the valuation professionals in assigning premiums to the various housing attributes as mentioned above. More so in Ghana, district, municipal and metropolitan assemblies impose property rates on houses and the valuation method prescribed by law for rating purposes is the replacement cost method. This method however, does not consider market dynamics and property characteristics. By finding empirical evidence about how much each housing characteristic influence property values, it will inform the policy makers to know exactly how these characteristics affect housing values and probably adopt the proper method of imposing the property rates instead of just depending on the cost of replacing the house.

In most of the housing studies that examine the determinants of house prices, the data is pooled together over time in order to increase the sample size and hence the degree of freedom. However, such estimation makes one implicit assumption – the implicit prices of the housing attributes are constant over time. Given that the demand and supply factors that determine the prices of houses change over time, this assumption is questionable and needs to be examined and addressed.

In the light of the preceding and using Kumasi, the second capital city of Ghana as the case study, the objectives of the paper are to: (a) examine the assumption of constancy of implicit prices of housing attributes; (b) estimate the magnitude and direction of influence of housing characteristics on property values; (c) determine the extent to which property value has changed over time in Kumasi; and (d) analyse the implications of the findings on property rating in Ghana. A study of this nature in the context of Ghana is notably non-existent.

The rest of the paper is structured as follows: Section 2 discusses the use of the hedonic pricing model as a tool for property assessment and administration. Section 3 also discusses the determinants of property values as evidenced in previous studies. In Section 4, the case study area is laconically

described. The research methodology adopted for the study is discussed in Section 5 while the penultimate Section concentrates on data presentation, analysis and discussion. Conclusions are summarised in the last Section.

2. The hedonic pricing model as a tool for property assessment

Housing is a composite commodity made up of different physical characteristics as well as locational and neighbourhood attributes. Unfortunately, the housing commodity is sold as a whole and these physical characteristics and neighbourhood attributes are not traded explicitly. The hedonic pricing technique is used as a tool to reveal the implicit prices of these attributes. The hedonic pricing model is based on the premise that the price/value of a good is determined by the utility that the various attributes of the particular product bears. When the property values are regressed on the various housing attributes, the empirical magnitudes of the coefficients of the various attributes constitute the hedonic prices of the various characteristics (Rosen, 1974; Fan et al., 2006; Wilhelmsson, 2009). The willingness to pay for the attributes, therefore, determines the price of the property.

Studies that have applied the hedonic pricing model in housing research have traditionally focused on making inferences about non-observable values of different attributes like neighbourhood amenities such as access to hospitals, schools, air quality and airport noise level (Janssen et al. 2001). Wilhelmsson (2000), for instance, uses the hedonic pricing model to assess the impact of traffic noise level on the value of single family houses in Sweden. The studies of Ong et al. (2003), Berry et al. (2003) and Wilhelmsson, (2009) have extended the research of Wilhelmsson (2000) to cover the physical housing attributes like the number of rooms and bathrooms, living areas and other areas. It has also been used to estimate households demand for various housing characteristics and to construct housing price indices (see for example, Can, 1992; Sheppard, 1999; Wilhelmsson, 2000; Clapham et al., 2006; Wilhelmsson, 2009). Despite the widely used of the hedonic pricing model, some studies have documented some problems of the model to include omitted variable bias, multicollinearity, heteroskedasticity, choice of functional form etc (see for example; Abdulai and Owusu-Ansah, 2010; Fan et al., 2006; Malpezzi, 2003; Sheppard, 1999).

One area in which the hedonic pricing model has been beneficial to researchers, practitioners and policy makers in the housing market is the area of assessing the value of properties, especially for rating purposes. Estimating or assessing the value of properties have traditionally focused on the use of conventional valuation methods like the comparable method, the income/investment method, the profit method, the residual/development method, and the contractor's/cost method. However, the use of the hedonic pricing model in assessing property values is now very common in most developed countries. The hedonic pricing model is indeed considered as one of the advanced valuation method in today's valuation practice (Pagourtzi et al., 2003).

One advantage the hedonic pricing model has in assessing property values for especially rating purposes is that it considers both the value of the building itself and the land on which the property is located by retrieving the implicit prices of the various housing and locational attributes from a pool of already transacted/valued properties. In this way, while methods like the replacement cost method ignore the value of the land on which the property is situated and concentrate on only the cost of replacing the building, the hedonic pricing model efficiently determine the contribution of the various housing attributes including the physical land to the value of the property and hence the amount to impose on a property as a tax.

In countries like Latvia, Poland and Denmark, the mass appraisal method which employs the hedonic pricing model is used to assess the value of properties for taxation purposes. In Sweden and Netherlands also, a computerised comparable sales method is used by the help of the hedonic method to assess the values of properties for taxation purposes. Despite the clear advantage of using the hedonic pricing model for property assessment, countries like the Czech Republic and developing countries like Ghana still use the cost approach to assess residential properties for taxation purposes. The problem of using this cost approach to assess properties for rating purposes in Ghana is highlighted at the concluding section.

3. Factors that affect residential property values

The determinants of property values can be grouped into many factors. Wilhelmsson (2000) for instance, identifies four main factors that affect demand for properties and hence the price, to include the property's structural attributes, its location or neighbourhood amenities, its environmental attributes and macro attributes like inflation and interest rate. However, for microeconomic and cross-sectional analysis like in this study, the independent variables are limited to property structural characteristics and location in terms of neighbourhood quality and accessibility (Bowen et al., 2001). Even though there are some disagreements on both the direction and magnitude of impact that certain housing characteristics have on housing values, some of them are very consistent in the literature. The location in terms of neighbourhood characteristics and accessibility, the structural property or physical characteristics, are discussed below:

3.1 Location

The importance of location in real estate is well known. There is a real estate adage that states that the three most important factors which determine property values are (i) location, (ii) location and (iii) location. Spatially, no two properties are the same and indeed, there is a consensus among valuers that location is the most important factor in property value determination (McCluskey et al., 2000). The importance of location is evident by the fact that location physically fixes a property in space and thereby defines its distance from features such as commercial, transportation and leisure activities. Again, in cases where houses within a particular sub-market or neighbourhood are homogeneous, many of the amenities that are common to those properties are best represented by location (Gelfand et al., 1998). Location is an inherent attribute of a house which directly determines the quality and hence the market value of the house. The theory of housing immobility is premised on location. The locational influences on the value of residential property may arise from a number of sources. These are grouped under neighbourhood quality and accessibility (McClauskey et al., 2000).

- Neighbourhood Quality

  Neighbourhood may be defined as a geographic area within which there is high degree of use homogeneous or similar between contiguous parcels. Neighbourhood is defined in an economic sense as an area within which relatively the same prices prevail for properties that permit approximately the same types of uses and socioeconomic status. The neighbourhood quality factors that influence residential property values include (a) exposure to adverse environmental factors (b) neighbourhood amenities (c) perceived levels of neighbourhood security etc. Depending on the presence or absence of these amenities, residential properties may reduce or increase in value (Gallimore et al., 1996).

  Wilhelmsson (2002) empirically examines the effect that traffic noise has on single-family houses in the Stockholm Municipality and finds that a single-family house that values at SEK 975 000 would be sold for SEK 650 000 if the property is located on or near a highly noise road. Traffic noise in this case reduces single-family property values by as much as 30%. Other empirical studies that have examined the effects of such environmental attributes on house prices and estimated the willingness-to-pay (WTP) for negative externalities include Hughes and Sirmans (1993), Palmquist (1992), etc.

  Neighbourhood amenities are the necessary services and attractions within the neighbourhood that makes life easy and comfortable for the inhabitants. If a particular site generally has good and high level of amenities like schools, hospitals, shopping facilities, leisure facilities, road and other transportation networks, etc, then it will be a more pleasant place to live in than other site with less amenity level. It will therefore be expected that higher prices will be paid to stay in such neighbourhoods. As Brigham (1965) note, the level of amenity in a neighbourhood is obviously a qualitative factor. It can therefore be determined subjectively by different individuals. Even though it cannot be measured directly, its value can be measured (Brigham, 1965).

  The perceived levels of security in a neighbourhood is determined by factors such as the level of crime, number of drug users in that neighbourhood, etc. (Gallimore et al., 1996). If there is low

level of crime and drug users in a neighbourhood for instance, coupled with the presence of police post, the security level will be high and the individuals within the neighbourhood will live in comfort and peace. Property values in such neighbourhood will therefore be higher than other neighbourhoods with less security. This is because all things being equal, consumers are more willing to pay a premium for areas with higher security because of the security and comfort; than for neighbourhoods with less security.

- Accessibility
  Easy and convenient accessibility within a neighbourhood will determine the price to pay for properties within a particular neighbourhood. Such accessibility measures involve property proximity to market, desirable supporting facilities such as transportation facilities, place of employment, shopping and leisure facilities etc. Generally, locations that afford relatively easy access to various necessary or desirable activities have higher property values than locations that do not have such easy access, with all other things being equal. Accessibility also relates to convenience of moving people and goods from one site to the other by overcoming the use of time and cost. Transportation involves cost and so how easily and convenient people can have access to place of work, recreational and social services will determine the value to pay for a particular location.

3.2 Physical Characteristics

The physical characteristics of a house influence the value to be placed on the house. These physical characteristics can be grouped as; accommodation and size; structural improvement and materials used; and age and condition of the structure.

- Accommodation and Size
  The level of accommodation provided by a house can influence the value or price to pay for the house. Such factors include the number of bedrooms and other rooms, the number of floors, floor size, land area etc. Generally, individual buyers have their own needs, taste and preferences concerning the amount of accommodation. Such accommodation needs, tastes and preferences are influenced by the size of the family, prestige and status of the individual etc. They therefore restrict their enquiries to properties having the number of rooms or size of property that they want. If individuals get the amount and size of accommodation they want, they will be willing to pay higher value for it than they would pay for property with more or less the amount of accommodation they require. As Sirmans et al. (2005) find, the number of rooms (bathrooms, public rooms and bedrooms) dominantly affects price in the positive direction. This means that as the number of rooms increase, the price of the property also increases.
- Structural Improvement and Materials Used
  The materials that goes into the construction of a property and the structural improvement made to the property affect the price to pay for the property. Physical factors such as the type, style and quality of floor finishes, roof, ceilings etc will influence the amenity to be derived from living in a particular property and hence the price to pay for that property. Structural improvements like the availability of garage, swimming pool, gardens, fence wall etc all affect the value of residential accommodation. Usually, the availability of improvements like swimming pool, garages and gardens in a property will make rational buyers pay higher price for such a property than they will pay for similar property without such improvements, all other things being equal.
- Age and Condition of Structure
  The age and condition of a property will also influence the price to pay for the property. In examining the factors that are mostly included in hedonic models to determine house prices, Sirmans et al. (2005) find that the age of property influence the value of the property mostly in the negative direction. This is not surprising because as the age of the property increases, the economic value of the property decreases and hence the utility to be derived from the property decreases. Furthermore, homebuyers would have to spend additional money on maintenance

when properties are old. They are, therefore, willing to pay a price lower than a new property of similar but new attributes. Apart from the age, the condition of the structure also affects the value to pay for the property. If a property is old but has seen a lot of refurbishment, it will demand higher price than a similar property that has not been refurbished.

In their survey of over 150 hedonic pricing studies of the housing market, Sirmans et al. (2005) find garage, number of bathrooms, age of property, house size, number of rooms and house type to be some of the factors that affect residential property values. Table 1 presents some of the variables reported by Sirmans et al. (2005) and the number of times they appear as well as the direction they affect house prices. As shown in Table 1, each of the characteristics appears to have a particular direction though in a few instances, goes the opposite direction. For example, 21 of the 40 studies that use the number of bedrooms as an explanatory variable record a positive effect on the price. Nine of them affect the house price in the negative direction and 10 of them have neutral effect. This means that there are some disagreements on the direction of impact of the number of bedrooms and the same could be observed for the other variables.

Table 1: Factors that affect residential property values

Name of housing characteristics	Number of times it appears	Number of Positive signs	Number of Negative signs	Number of neutral signs
Number of floors	13	4	7	2
Number of bathrooms	40	34	1	5
Number of public rooms	14	10	1	3
Number of bedrooms	40	21	9	10
Garage	61	48	0	13
Age	78	7	63	8
Square Feet	69	62	4	3
Fireplace	57	43	3	11
Pool	31	27	0	4

Source: Adapted from Sirmans et al. (2005)

4. A brief description of Ghana and the housing market in Kumasi

Ghana is located in the Sub Saharan Africa with a total land area of about 239,000 square kilometres. Currently with a population of about 25 million (Ghana Statistical Service, 2011), the country is divided into ten administrative regions with Accra as the capital city. Table 2 shows a summary of the social, economic and demographic profile of Ghana.

Table 2: Summary of profile of Ghana

Items	Facts
Population	24,791,073 (2011 estimate)
Official language[1]	English
Religion	Christianity, Islam and traditional beliefs
Currency	Cedi
GDP	US$61.97bn (2010 estimate)
Annual GDP growth	5.7% (2010 estimate)
Inflation rate	10.9% (2010 estimate)
Major resources	Cocoa, Gold, Oil and Timber

[1] There are about 75 other spoken languages including Akan, Ewe, Ga and Hausa.

Kumasi is the second largest city in Ghana and the centre of the seat of the ancient Asante Kingdom. It is the political and administrative capital of the Ashanti Region, and most activities in the northern sector of Ghana are carried out in the city. The presence of both the Asantehene (King and Traditional High Priest of the Asante people) and the Golden stool (apex of cultural and traditional religious structures) in Kumasi (Wilks, 1975) make the city very important, popular and influential in Ghana and Africa as a whole.

The housing market in Kumasi, like other Ghanaian cities is characterised by renting. According to Tipple and Korboe (1998), about 75% of households in Kumasi rent their rooms or houses. The housing market in Kumasi is categorised into three main residential classes. These are the first class, the second class, and the third class residential classes. The first class residential area is also sub-categorised into three. Table 3 provides the various classifications and the areas that fall under each classification.

Table 3: Residential Classes in Kumasi

	First (1st) class	
Number of suburbs in category 'A'	Number of suburbs in category 'B'	Number of suburbs in category 'C'
5	8	5
Number of suburbs in the second (2nd) class	Number of suburbs in the third (3rd) class	
45	43	

Source: The Lands Commission, Kumasi. (2010)

The first class residential areas are usually quiet residential areas with various amenities and accessibility factors that make living conducive. Not only are those areas quiet, but are also very close to the CBD, making vehicular and pedestrian accessibility to the CBD very easy. Crime rate in such areas is also very low with the presence of police patrol in the areas. Most of the properties in such areas are single family detached properties. Not surprisingly, the areas are mostly occupied by politicians, top public service officials, the rich and the elites in society. Average land values in such areas ranges between GH¢300,000 to GH¢450,000 per acre and lot sizes tend to be relatively bigger (Kumasi Lands Commission, 2010).

The second class and third class residential areas are characterised by mixed residential properties like semi-detached, flat, and multi-family properties usually referred to in Ghana as the traditional compound houses, dominate. Such compound houses are typically two-storeys with 10 to 15 bedrooms. In such areas, basic amenities like schools, hospitals are available and accessible. However, the third class residential areas are normally condensed, overcrowded and noisy. The crime rate in the third class residential areas is also more than in the second class residential areas. It is therefore expected that land values are higher in the second class residential areas than in the third class residential areas. Plot sizes in second and third class residential areas are about 0.25 acre. In recent times, Kumasi is rapidly expanding as peri-urban farmlands are being converted into residential plots. Demand for undeveloped residential plot is high. Uncompleted residential buildings in 'new site' are also far outnumbering completed ones.

5. Research Methodology and sources of data used

The research approach used for the study is the quantitative research methodology. Specifically, the hedonic pricing model is used to estimate the influence of or the marginal contribution of each property and neighbourhood characteristic to the house value.

5.1 The hedonic pricing model

The hedonic model used for this study is of the form:

$$Y_i = \alpha + \sum_{i=1}^{I} \beta X_i + \sum_{i=1}^{I} \gamma D_i + \varepsilon_i$$

where Y_i represents the dependent variable, the natural logarithm of the value of the property *i*. The log transformation of the dependent variable is used because it makes the interpretation of the regression coefficients easy – as the percentage change in the value given a unit change in the housing attribute; allows for variations in the currency value of each housing characteristic; and finally, helps to minimise the problem of heteroskedasticity (Follain and Malpezzi, 1980). β represents the regression coefficients associated with the exogenous independent variables (the housing and locational characteristics), *X* of property *i. D* is a matrix of dummy variables, which represents the various residential classes, the availability of garage, fence wall, swimming pool, land registration and the yearly time dummies of property *i*. The stochastic or error term, ε, represents all relevant attributes of property *i* that are not captured by the matrixes *X* and *D*. This means that no omitted variable bias problem exists.

5.2 Testing for the constancy of the hedonic characteristics prices over time

This assumption of the constancy of the implicit prices of the hedonic characteristics underlying most hedonic studies that pool data together is tested using the Chow Test (Chow, 1960). It is a statistical test of whether the coefficients of the parameters in two different datasets are equal. From the hedonic model above, the data is split into two and assume that the coefficient estimates are different for each of the datasets. The model for each of the datasets will then become:

$$Y_i = \alpha_1 + \sum_{i=1}^{I} \beta_1 X_i + \sum_{i=1}^{I} \gamma_1 D_i + \varepsilon_i$$

and

$$Y_i = \alpha_2 + \sum_{i=1}^{I} \beta_2 X_i + \sum_{i=1}^{I} \gamma_2 D_i + \varepsilon_i$$

The null hypothesis, H_0, of the Chow test asserts that $\alpha_1 = \alpha_2$, $\beta_1 = \beta_2$, $\gamma_1 = \gamma_2$. That is, according to H_0, all the coefficients (including the intercept) are the same in each of the data groups. This can be tested by using the sum of squares test. Let SSR_C be the sum of squared residuals from the combined data, SSR_1 be the sum of squared residuals from the first data group, and SSR_2 be the sum of squared residuals from the second group. N_1 and N_2 are the total number of observations in each group and *k* is the total number of parameters. The Chow test statistic under H_0 becomes:

$$\frac{((SSR_C) - (SSR_1 + SSR_2))\ \ (k)}{(SSR_1 + SSR_2)\ \ (N_1 + N_2 - 2k)}$$

This test statistic follows the F distribution with k and N_1+N_2-2k degrees of freedom. If the null is rejected, then it means that the coefficient estimates are different for the different data groups, and so pooling the data together is unwarranted.

5.3 Sources of data used

The dataset used for the study comprises of residential property values in Kumasi from the year 2005 to the year 2010, a total of 6 years. Even though transaction data has been mostly used for hedonic analysis, such data is rarely available in Ghana because the property market is not well developed and property transactions are rarely recorded. Admittedly, property value data may not be a true reflection of sample of properties that may have been sold, but rather of opinions formed by professional real estate valuers. Even though the valuations may not be perfect, they can be analyzed as "unbiased" estimators of the market value of those properties. The hedonic price estimates from an appraisal-based database are unbiased because policy and professional appraisal practice effects can be construed as either random or systematic within the context of the model specification of the hedonic price function. The random effects are contained in the stochastic error term for the hedonic price specification. The systematic effects on hedonic price model tend to operate as a scalar so that log transformation of the hedonic price model estimator leaves the structural coefficient vector for the hedonic price function unbiased (See, Megbolugbe, 1986 for further discussion). Furthermore, the estimated values may be more accurate than opinions of values home owners may form for their properties since the real estate valuers are better informed about the current market prices. The use of the valuation data for this study

is therefore not inconsistent with previous studies that have used transaction data (Bourassa et al., 2006) and so does not bias the results.

The data was sourced from various valuation firms, estate agents, and the land sector agencies in Kumasi such as the Lands Valuation Board and the Lands Commission. In all, a total of 20,586 residential property valuations are available for this study. However, not all the property valuations between these periods have been used for the analysis – this is because some of them do not constitute a fully consistent body of data for the purpose of residential property value analysis. Notably, any valuation that does not have data on any variable or housing characteristic is excluded. Again, properties whose valuations may not represent open market value, for example, valuing properties for the purpose of compulsory acquisition are excluded since they are not fair representation of the true value. After cleaning the data, the empirical analysis is based on a total of 18,652 property valuation data between 2005 and 2010 inclusive, with an average of 3,109 property valuations per year.

Table 4 defines the variables contained in the valuations that have been identified in previous empirical studies as the determinants of property values and so used in this study. These variables comprise of both physical property characteristics and locational variables. The physical property characteristics include the number of bedrooms, the property area, number of floors, bathrooms, public rooms and age of the properties. The residential classes are used as neighbourhood dummies to measure the impact of location on property values. The dummy variables like garage, fence-wall and swimming pool measures the impact that housing amenities have on the value of the house. Land registration as a dummy variable helps to find out the impact that land registration has on property values. Lastly, the yearly time dummies (Year2005-Year2010) help to identify the pattern of residential property values over the 6 year period.

Table 4: Variable definitions

Variable	Definition
Value	This is the open market value estimate for the property. It's natural logarithm is used as the dependent variable
Bedroom	Number of bedrooms in the property
Propertyarea	The total area occupied by the property
Floor	Number of floors
Bathroom	Number of bathrooms
Publicroom	Number of public rooms which include living rooms, dining rooms and kitchens.
Age	Age of the property
Res_class	The residential class area where the property is situated. This is a dummy variable which takes the value of 1 if a property is located in a particular the residential class, 0 otherwise.
Garage	This is a dummy variable which takes the value of 1 if a property has a garage, 0 otherwise.
Fence_wall	This is a dummy variable which takes the value of 1 if a property has a fencewall, 0 otherwise.
Pool	This is a dummy variable which takes the value of 1 if a property has a swimming pool, 0 otherwise.
Land_registeration	This is a dummy variable which takes the value of 1 if the land on which the property is situated is registered, 0 otherwise.
Year2005-Year2010	This is a dummy variable which takes the value of 1 if the house is valued in a particular year, 0 otherwise.

6. Presentation of data, analysis and discussion

This section presents and discusses the empirical results obtained from the study. Firstly, the descriptive statistics of the dataset is presented followed by the results from the regression model.

6.1 Descriptive statistics

Table 5 below presents the descriptive analysis of the variables used in the regression model. As shown in the Table, the average price over the period is around GH¢125,000. The standard deviation is around 68% of the average price, suggesting that property values are volatile in the city. The lowest transaction price over the period is as low as GH¢65,000 and the highest transaction price (for that matter the most expensive house) over the period is around GH¢820,000. Each house transacted over the period has an average of 4.3 number of bedrooms. The houses with the lowest and highest number of bedrooms have 1 and 12 rooms respectively. The average number of bathrooms, public rooms, floors are are 2.2, 2.8 and 1.4 respectively. That is, the ratio of bedroom to bathroom is around 2:1. The average age of the properties transacted over the period is 35 years with average property area of around 590.3 M^2.

Table 5: Summary statistics

Variable	Mean	Std. dev	Min	Max
Value (GH¢)	124869.9	85517	65,032	820,184
Bedroom (Number)	4.25	2.31	1	12
Bathroom (Number)	2.23	1.66	1	7
Publicroom (Number)	2.81	1.35	1	6
Floor (Number)	1.44	0.65	1	3
Age (Years)	35.19	13.54	10	75
Propertyarea (M^2)	590.30	1103.25	12.3	4964.96

6.2 The hedonic regression analysis and the Chow Test

Panel A of Table 6 presents the empirical results from the regression pricing model. The estimated coefficients of the variables are presented in percentages with the corresponding *t*-values in parentheses. The Table shows three empirical results. The first column shows the variables used in the study. The second column indicates the results from the regression using the entire dataset. The third column shows the results from the regression using the dataset from years 2005 to 2007, whilst the fourth column, shows the results obtained by using the dataset from years 2008 to 2010.

Table 6: Hedonic model estimates

Variable	Coefficient		
	All periods (years 2005-2010)	Period one (years 2005-2007)	Period two (years 2008-2010)
Bedroom	0.254 (3.01)	0.263 (2.53)	0.267 (2.93)
Bathroom	0.235 (8.48)	0.248 (7.42)	0.249 (7.49)
Publicroom	0.157 (13. 69)	0.131 (11.24)	0.134 (11.76)
Floor	0.062 (4.56)	0.063 (2.89)	0.059 (2.87)
Age	-0.086 (-37.01)	-0.072 (-31.27)	-0.072 (-31.34)
Propertyarea	0.012 (1.82)	0.011 (1.67)	0.013 (1.68)
First_class	2.344 (34.81)	2.359 (33.64)	2.312 (32.08)
Second_class	0.848 (32.18)	0.857 (27.45)	0.865 (29.51)
Garage	0.188 (15. 71)	0.173 (14.21)	0.168 (14.97)
HasFence_wall	0.142 (9.85)	0.137 (9.36)	0.135 (9.01)
Has_Pool	0.447 (18.64)	0.435 (15.62)	0.451 (18.37)
Registered_land	0.186 (18.07)	0.188 (17.21)	0.189 (17.65)
Adjusted R^2	72.4%	69.8%	70.3%

Chow Test Statistic	P-value
1.02	0.114

As shown in the second column of the Table, the regression model explains approximately 72% of the total variation in property values, which is represented by the R^2. This means that about 72% of the variations in property values are actually explained by the model over the period. Only 28% is left unexplained. This suggests that the model is a good one given a cross-sectional dataset like this one. All the estimated parameters, except property area, are statistically significant at a 5% significance level. This is because all their *t*-values have an absolute value of more than 1.96, which is the critical value for 95% confidence interval. In the third and the fourth columns also, the model explains approximately 70% of the total variation in property values. This means that only about 30% is left unexplained. That is, combining the datasets increases the explanatory power from 70% to 72%.

By splitting the data into two, the results in columns three and four show that the coefficient estimates for the split datasets are not the same, though a bit similar. However, it is not known whether the differences in the coefficient estimates are statistically significant and so whether the pooling of the data together is unwarranted. The Chow Test discussed in the methodology section is used to test this. The panel B in Table 5 presents the results from the Chow Test. The table shows that the test produces F-statistics of 1.02 with a p-value of 0.114. This means that even at a 10% significant level, we cannot reject the null hypothesis that the coefficient estimates between the two groups of datasets are the same. That is, the difference between the coefficients estimates of the two datasets, together with their intercepts are statistically not significant and so splitting the data into two is not necessary in this study. More so, since the pooling of the data improves the explanatory power as shown in the first column of panel A, there is no need to split the data. This is in sharp contrast to the studies by Berndt and Rappaport (2001) and Pakes (2003) who find a significant parameter inconstancy. Even though no evidence of parameter inconstancy is found in this study, it may mainly due to the relatively short period of time (6 years) used in this study. Perhaps, if the study covers a longer period, the coefficient estimates might have changed.

The results from the combined dataset (column two) show that the numbers of bedrooms, bathrooms and public rooms all have the positive expected. The number of public rooms records a coefficient of 15.7%. This means that as the number of public rooms increases by 1 unit, the value of properties increases by an average of 15.7% in the combined dataset. A unit increase in the number of bedrooms increases property values by an average of some 25.4% and a unit increase in the number of bathrooms increases property values by an average of 23.5%. Thus, in terms of the impact of rooms on residential property values, bedroom has the greatest influence, followed by bathroom; and public room has the least impact. The positive sign supports the argument that as the number of rooms increase, the total area of the property also increases. As the area increases, homebuyers are able to reduce overcrowding in the property and hence increase their utility. This will, therefore, make them willing to pay higher price for the property.

The number of floors also records positive in the combined dataset. The coefficient of 6.2% means that if the number of floors a house has increases by 1, the value of that property increases by some 6.2%. The positive sign supports the argument that as the number of floors increases, the number of rooms and for that matter the total area of the property also increases, and hence increases in the property value. The property area, although insignificant has the expected positive sign. The insignificant of the property area may be due to the fact that the number of rooms and floors have already captured the impact of the total property area on the value of the property.

The age of the property has a negative impact on property values. As the age of the property increases by a year, all other things being equal, the value of the property reduces by approximately 9% in the second column where the entire dataset is used. This is not surprising because as the age of the property increases, the economic value of the property decreases and hence the utility to be derived from the property decreases. Furthermore, homebuyers would have to spend additional money on

maintenance when properties are old. They are, therefore, willing to pay a price lower than a new property of similar but new attributes.
The availabilities of a garage, fence wall and pool, are also significant on a 5% level, and the direction of impact is positive if the property has these amenities. If a property has a garage, on average the value of that property is 19% more than if it does not have a garage as shown in the second column. The value of a property with a fence wall is also approximately 14% more than the value of a property without a fence wall. Also, when a property has a swimming pool, the value of that property is about 45% more than the value without a swimming pool. This finding is not surprising because these amenities increase leisure and satisfaction, and hence the willingness to pay more for them.
The value of a house situated on a registered land is about approximately 19% more than the value of house situated on an unregistered land. This is not surprising because when the land is registered, it gives the owner some security of tenure and in case litigation arises as to the ownership of the land, a certificate of land registration settles the case. The location of the property is also found to have the greatest impact on the property values. When a house is located in a first class residential area, the value of that house will be about 234% more than the value of a similar house located in a third class residential area, and 149% (234% - 85%) more than the value of the same house in a second class residential area. Also, the value of a house located in a second class residential area is about 85% more than the value of a house in a third class residential area. These findings are not surprising given the description of the various residential classes in the literature above. The time dummies are also included in the regression equation but their coefficient estimates are used to analyse the trend in residential property values below.

6.3 Trend in residential property values over the period
Figure 1 shows the pattern of residential property values over the 6-year study period. The yearly time dummies from the regression model using the entire dataset is used to construct this value trend. The year 2005 is used as the base period and the changes in the property values start from that year. It is clear that in general, residential property values have been rising over the years with an average of about 8.2% every year. Between years 2005 and 2010, house values have risen by about 49%.

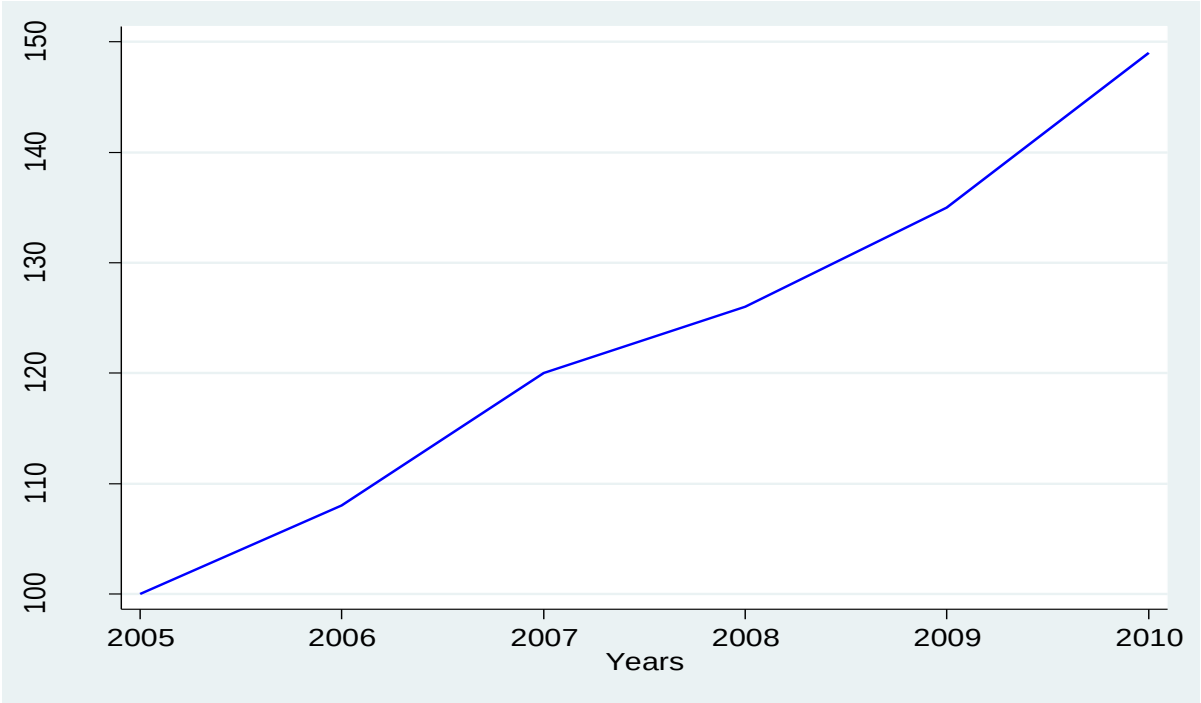

Figure 1: Trend in Property values over the period

One striking thing from Figure 1 is the fact that property values have always been increasing despite the global crash in the housing market after the year 2007. This suggests that the housing market in Kumasi, and for that matter in Urban Ghana, is not affected by global economic factors or any external factors. The factors that influence the housing market are localised.

7. Conclusion and policy implications

This study has employed the hedonic model to investigate the determinants of residential property values in Urban Ghana, with Kumasi as the case study area. Overall, the hedonic model explains approximately 72% of the total variation in residential property values over the six- year period, using the entire dataset. Pooling the data together to do the analysis is necessary and justified because the Chow Test reveals that the coefficient estimate of the housing characteristics are statistically the same over the study period. All the housing characteristics except the property area are statistically significant at a 5% significant level when the entire dataset is considered. This means that with the exception of property area, determinants of property values in Urban Ghana include all the independent variables used in the study namely: number of bedrooms, bathrooms, public rooms, floors; age, residential class; availability of garage, fence wall, and swimming pool; as well as land registration - whether the land on which the property is situating is registered or not.

The residential area where the property is located has the greatest impact on residential property values. The values of properties located in first class residential areas are about 234% and 149% higher than values of properties located in third class and second class residential areas respectively. Also, properties located in the second class residential areas are about 85% higher than similar properties located in the third class residential areas. Number of floors is also found to have the lowest effect on property values. The number of bedrooms affects property values more than the other rooms like kitchen, bathrooms, etc.

Lastly, the values of residential properties have risen approximately 49% over the study period and the values have always been rising despite the crash in the housing market in year 2007 and beyond.

The findings from this study clearly questions the use of the replacement cost method as the basis for property rating in Ghana. By using the replacement cost method, the property rates are imposed on the properties based on the cost of the physical structure without due consideration to the value of the land on which the property is situated. This study has however revealed that the residential class where the physical structure is situated, that is, the value of land has the greatest impact on the value of the property. Properties in first class residential areas are about three to four times higher than properties in third class residential areas and properties in first class residential areas are about two to three times higher than properties in second class residential areas. Thus, by not taking into account the value of the land, or considering it arbitrary, the system of imposing property rating in Ghana cannot be considered as fair and the local governments are losing considerable chunk of revenue.

References

Abdulai, R. T. (2010). Traditional Land holding Institutions in sub-Saharan Africa - The Operation of Traditional Landholding Institutions in Sub-Saharan Africa: A Case Study of Ghana. Germany: LAP Lambert Academic Publishing.

Abdulai and Owusu-Ansah (2010). House Price Determinants in Liverpool, United Kingdom. *Current Politics and Economics of Europe*, **22**(1), pp. 1-26

Arimah B.C. (1992a). An Empirical Analysis of the Demand for Housing Attributes in a Third World City, *Land Economics,* **68**(4)*,* pp*.* 366—379

Arimah B.C. (1992b). Hedonic Prices and the Demand for Housing Attributes in a Third World City: The Case of Ibadan, Nigeria, *Urban Studies,* **29**(5)*,* pp*.* 639—651

Asabere, P.K. *(*1981*)* The determinant of land values in an African city*, Land Economics,* **57***,* pp*.* 385—397

Ball, M. J. (1973). Recent empirical work on the determinants of relative house prices. *Urban Studies,* **10**, pp. 213-33.

Bell, K. C. (2006). World Bank Support for Land Administration and Management: Responding to the Challenges of the Millennium Development Goals. Paper presented at the 23rd FIG Congress, Munich Germany.

Bello M.O. and Bello V.A. (2008). Willingness to pay for better environmental services: evidence from the Nigerian real estate market. *Journal of African Real Estate Research*, **1**(1), pp.19-27

Bello V.A. (2000). An empirical analysis of the determinants of residential property values in Lagos Metropolis. M.Tech thesis, Department of Estate Management, Federal University of Technology, Akure.

Benson, E. D., Hansen, J. L., Schwartz Jr., A. L. and Smersh, G. T. (1998). Pricing Residential Amenities: The Value of a View. *Journal of Real Estate Economics and Finance*, **16**, 55-73.

Berndt, E. R. and Rappaport, N. (2001). Price and quality of desktop and mobile personal computers: A quarter-century historical overview, *American Economic Review*, **91**, pp. 268–273.

Berry, J., McGreal, S., Stevenson, S., Young, J. and Webb, J. R. (2003). Estimation of apartment submarkets in Dublin, Ireland, *Journal of Real Estate Research*, **25**(2), pp.159-170.

Bourassa, S. C., Hoesli, M. and Sun, J. (2006) A simple alternative house price index method, *Housing Economics* **15**, pp. 80-97.

Bowen, W., Mikelbank, M. and Prestegaard D. 2001. Theoretical and Empirical Considerations Regarding Space in Hedonic Housing Price Models. *Growth and Change.* **32**, pp. 466-90.

Brigham, E. (1965). The Determinants of Residential Land Values, *Land Economics*, **41**, pp. 325–334.

Can, A. (1992). Specification and estimation of hedonic housing price models. *Regional Science and Urban Economics*, **22**, pp.453-74.

Chau, K. W. and Zou, G. (2000). The interaction between economic growth and residential investment. Working Paper, University of Hong Kong.

Chow, G. C. (1960). Tests of Equality Between Sets of Coefficients in Two Linear Regressions, *Econometrica*, **28**, pp. 591–605.

Clapham, E., P. Englund, J. Quigley and Redfearn, C. (2006). Revisiting the past and settling the score: index revision for house price derivatives, *Real Estate Economics*, **34**(2), pp. 275-302.

Coulson, N.E. and Kim, M.S. (2000). Residential investment, non-residential investment and GDP, *Real Estate Economics*, **28**(2), pp. 233-247.

Fan, G-Z, Ong, S. E. and Koh, H. C. (2006). Determinants of House Price: A Decision Tree Approach, *Urban Studies,* **43**(12), pp. 2301-2315.

Gallimore, P., Fletcher, M. and Carter, M., (1996). Modelling the Influence of Location on Value. *Journal of Property Valuation and Investment,* **14**(1), pp. 6-19.

Gelfand, A. E., Ghosh, S. K., Knight, J. R. and Sirmans, C. F. (1998). Spatio-Temporal Modeling of Residential Sales Data, *Business and Economics Statistics* **16**, pp. 312–321.

Green, R.K. (1997). Follow the Leader. How changes in residential and non-residential investment predict changes in GDP, *Real Estate Economics*, **25**(2), pp. 253-270.

Grether, D. M. and Mieszkowski P. (1974). Determinants of Real Estate Values. *Journal of Urban Economics*, **1**, pp.127-46.

Hale, D. (2008). The Global Driver: How Housing is Driving the World Economy, Gale: Cengage Learning.

Hughes, W. T. and Sirmans, C. F. (1993). Adjusting House Prices for Intra neighbourhood Traffic Differences. *Appraisal Journal* **61**, pp. 99–119.

Janssen, C. B. and Soderberg, J. Z. (2001). Robust estimation of hedonic models of price and income for investment property. *Journal of Property Investment and Finance,* **19**(4), pp. 342-60.

Kiel, K.A. and M.A. Boyle. (2001). A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities. *Journal of Real Estate Literature* **9**(2), pp. 117-144.

Kim, K. and Park, J. (2005). Segmentation of the housing market and its determinants: Seoul and its neighbouring new towns in Korea. *Australian Geographer*, **36**(2), pp. 221-232.

Leung, C. (2003) Economic growth and increasing housing price. *Pacific Economic Review*, **8**(2), 183-190.

Liu, H., Yun, W.P. and Zheng, S. (2002). The interaction between housing investment and economic growth in China, *International Real Estate Review*. **5**(1), pp. 40-60.

Malpezzi, S. (2003). Hedonic pricing models: A selective and applied review. In: O'Sullivan, T. and Gibb, K. (Eds.), *Housing Economics and Public Policy*. Oxford: Blackwell, pp. 112-122.

McCluskey, W. J., Deddis, W. G., Mannis, A., Lamont, I. G. and Borst, R. A. (2000). The application of Surface Generated Interpolation Models for the Prediction of Residential Property Values, *Property Investment and Finance*, **2**, pp. 162-179.

Megbolugbe I.F. (1991) Hedonic Indices and Housing Programme Benefits. *Urban Studies*, **28**(5), pp.773-781

Megbolugbe I.F. (1989) A Hedonic Index Model: The Housing Market of Jos, Nigeria. *Urban Studies*, **26**, pp.486-494

Megbolugbe I.F. (1986) Econometric Analysis of Housing Trait Prices in a Third World City. *Journal of Regional Science*, **26**(3), pp.533-547

Ong, S. E., Ho, K. H. D. and Lim, C. H. (2003). A constant-quality price index for resale public housing flats in Singapore. *Urban Studies*, **40**(13), pp. 2705-2729.

Pagourtzi, E., V. Assimakopoulos, T. Hatzichristos and N. French (2003). Real Estate Appraisal: a review of valuation methods. *Journal of Property Investment and Finance*, **21**(4), 383-401.

Pakes, A. (2003). A reconsideration of hedonic price indexes with an application to PCs, *American Economic Review* **93**, pp. 1576–1593.

Palmquist, R. B. (1992). Valuing Localized Externalities, *Urban Studies* **31**, pp. 59–68.

Pasha H.A. and Butt M.S. (1996). Demand for Housing Attributes in Developing Countries: A study of Pakistan. *Urban Studies*, **33**(7), 1141-1154.

Rosen, S. (1974) Hedonic prices and implicit markets: Product differentiation in pure competition, *Journal of Political Economy*, **82**(1), pp. 34-55.

Sheppard, S. (1999). Hedonic analysis of housing markets. In: Cheshire, P. C. and Mills, E.S. (Eds.) *Handbook of Regional and Urban Economics*. Amsterdam: Elsevier, pp. 34-41.

Sirmans, G. S., Macpherson, D. A. and Zietz, E. N. (2005). The composition of hedonic pricing models. *Journal of Real Estate Literature,* **13**(1), pp. 3-43.

Sirmans, G. S., Zietz, E. M. and Zietz, J. (2008). Determinants of House Prices: A Quantile Regression Approach. *Journal of Real Estate Finance and Economics*, **37**, pp. 317-333.

Tipple G. A. and Korboe D. (1998) Housing Policy in Ghana:Towards a Supply-Oriented Future. *Habitat Int*., **22**(3), pp. 245-257.

Wen, Y. (2001). Residential investment and economic growth, *Annals of Economics and Finance,* **2**(2), 437-444.

Wilhelmsson, M. (2000). The Impact of Traffic Noise on the Values of Single-family Houses. *Journal of Environmental Planning and Management*, **43**(6), pp.799–815.

Wilhelmsson, M. (2009). Construction and updating of property price index series. The case of segmented markets in Stockholm. *Property Management*, **27**(2), pp.119-37.

Wilks, I. (1975) *Asante in the Nineteenth Century*. Cambridge : Cambridge University Press.

Zietz, J., Zietz, E. N., and Sirmans, G. S. (2008) Determinants of house prices: A quantile regression approach, *Journal of Real Estate Finance and Economics*, **37**, pp. 317-33.