HOUSE PRICE ESTIMATION USING HEDONIC APPROACH FOR MASS APPRAISAL MODEL IN MINNA, NIGERIA

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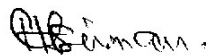
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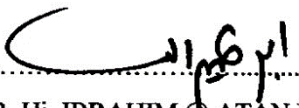
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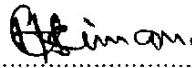
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To my beloved mother, late father, and to the ummah

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بسم الله الرحمن الرحيم، وصلى الله على نبينا محمد وعلى آله وصحبه وسلم

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ABSTRACT

The purpose of this research is to develop a mass appraisal model for house price estimation using hedonic price modelling approach for Minna, Nigeria. Three basic micro determinants of house price were considered namely structural, locational and neighborhood attributes. Using a sample of 91 transaction data recorded between 2009 to 2013, the hedonic based multiple regression analysis (MRA) was used to determine the variables that have statistically significant influence on price of a house. It was established that all the variables included in the MRA were significant except the number of rooms. The significant variables were the type of house, the size, number of bathrooms, location, age, year of transaction, condition of the house, its distance to the central business district (CBD) and the neighborhood facilities available. Using these significant attributes, a mass appraisal model for residential property taxation was developed for the study area. The performance of the model was evaluated using the ratio study technique and the model was found to be adequate. It was recommended that this model be used in mass appraisal of residential properties in Minna in the future, with a view to improve accuracy, efficiency and fairness of the real property tax system, which will lead to generating more revenue for the government which will foster physical infrastructural development in Minna.

ABSTRAK

Tujuan kajian ini adalah untuk membangunkan satu model penilaian massa bagi menentukan harga rumah dengan menggunakan pendekatan model harga hedonik untuk Minna, Nigeria. Tiga asas penentuan atribut harga rumah iaitu struktur, lokasi dan kejiranan. Sampel sebanyak 91 data transaksi diantara tahun 2009 hingga 2013 telah digunakan. Berdasarkan analisis model hedonik regresi berganda (MRA) yang mana bertujuan untuk menentukan pembolehubah yang mempunyai pengaruh beerti pada harga rumah. Ia telah menunjukkan bahawa semua pembolehubah adalah beerti kecuali bilangan bilik. Pembolehubah beerti adalah jenis rumah, saiz, bilangan bilik mandi, lokasi, umur, tahun transaksi, keadaan rumah, jaraknya ke daerah perniagaan pusat (CBD) dan kemudahan kejiranan yang ada. Dengan menggunakan atribut-atribut penting, model penilaian massa cukai harta tanah kediaman telah dibangunkan bagi kawasan kajian. Prestasi model yang dinilai menggunakan teknik kajian nisbah dan model didapati boleh ditrima. Kajian mencadangkan model ini digunakan dalam penilaian massa untuk hartanah kediaman di Minna pada masa akan datang bagi tujuan meningkatkan ketepatan, kecekapan dan keadilan sistem cukai harta. Ia akan menjana lebih banyak pendapatan bagi kerajaan dalam usaha memupuk pembangunan infrastruktur fizikal di Minna.

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CHAPTER 1

INTRODUCTION

1.1   Background to the Study

Housing plays a fundamental role to both the society and economy. It caters for one of the fundamental human needs by providing shelter, that is, a place to live and also has influence on people's well-being. Housing serves as a long term investment which accounts for a large proportion of household wealth (FTI, 2012). For many households therefore, housing serves as the single most important asset in their portfolio (Case et al, 2001).

The property market is one in which real property are exchanged between sellers and buyers. The market is not a single entity; there are a number of ways in which it can be classified. Such classification can be by sector (residential, commercial, agricultural, recreational or industrial); by location (local, regional, national or international), or by type of demand (occupation, ownership, investment, speculation or development) (Armatys et al., 2009; Shapiro et al., 2013). A larger proportion of the market is made up of the residential sector (Ismail, 2005). The property market is imperfect due to its inherent characteristics such as heterogeneity, huge sum of capital involved and high cost of transaction. Its nature, the methods of conducting transactions in it and lack of information relating to the transactions due to their private nature contribute to its imperfection (Shapiro et al 2013). These transactions can continue to remain private and confidential as successful buyers and sellers may not be willing to disclose the amount at which the properties were

exchanged. This can result in future buyers and sellers not having adequate knowledge of the actual level of demand and supply and thus what the expected market value will be (Blackledge, 2009).

Property valuation is required for different purposes including sales and purchase, letting, leasing, taxation, insurance, mortgages, balance sheet, inheritance, compensation, investment and financing among others (Blackledge, 2009; Pagourtzi et al., 2003). Similarly, the knowledge of house prices is of great importance to different market players such as appraisers, real estate agents, tax assessors, local authorities, banks and other financial institutions, property developers, investors, financial analysts, policy makers, insurers and in fact, the general public (Joseph, 2010; Schulz and Werwatz, 2004; Pagourtzi et al., 2003).

The valuation of real estate has customary been done using the traditional methods of valuation which are comparison, cost, investment, profit and residual methods (Selim, 2008). These approaches are still useful for single property valuation. It is however argued in the literature that they are not efficient for valuing large group of properties especially for the purpose of taxation. There is therefore need for a shift in paradigm to more reliable methods of valuing properties. Thus, new approaches and techniques for mass appraisal of real estate have been introduced.

Mass appraisal is "the process of valuing a group of properties as of a given date and using common data, standardized methods, and statistical testing (IAAO, 2013a)." It usually involves large group of properties as against individual property (Kauko and d'Amato, 2008). Mass appraisal started in the United States in the 1920s, and has since then continued to evolve (The Florida Department of Revenue, 2002). It has been adopted in developed countries like America, the UK and other European countries. Research in the field of mass appraisal is also gaining more prevalence in some developing countries such as Malaysia. However, there is very little evidence of the application of hedonic price model in house price studies, particularly in the context of mass appraisal in the Nigerian property market.

Hedonic regression has become the standard approach for modelling house prices (Schulz and Werwatz, 2004). The model posits that "a good possesses a myriad of attributes that combine to form bundles of utility-affecting attributes that the consumer values (Ching and Chau, 2003)." The earliest formalized use of the hedonic model is attributed to Rosen (1974) who is believed to be the first to apply the model to housing studies. The hedonic pricing model tends to estimate the price of the house as a function of its attributes. Other advanced techniques that are used in mass appraisal include artificial neural networks, spatial analysis, fuzzy logic, kriging, and ARIMA (Mohamad, 2012).

House prices can be influenced by both macro and micro factors. The macro factors that can affect house price include demand and supply, interest rate, inflation, employment rate, as well as taxes. On the other hand, the micro factors encompass both structural attributes (for example condition, age, floor area, garage, gate, design, facilities, number of bedrooms, and number of bathrooms among others) and location (neighbourhood and accessibility) of the house (Mohamad, 2012). The hedonic pricing model is used to estimate the extent to which each of these attributes affects the price of a house.

Against this background, this research work intends to employ the hedonic price model with a view to determine the micro factors that affect property prices in the study area in order to develop a mass appraisal model for the study area. The study intends to propose an objective method of mass appraisal of residential real estate for the purpose of taxation.

1.2 Problem Statement

The accuracy of valuation exercises is very important to real estate professionals (Sipan and Ab Rahman, 1996) and other market players. However, "the traditional single valuation method contributes to the inconsistency of assessed value

because location factors are not considered objectively (Sipan et al., 2012)." Apart from its subjectivity issue, the inconsistencies and errors involved and the lack of evidence to be used by valuers in adopting the traditional sales comparison approach also makes the valuation process difficult, thereby resulting in inaccuracy of valuation opinion (Bozic et al., 2013). This is even more evident when a lot of properties need to be valued at the same time. Due to lack of any standardized procedure for determining house value in Minna, people usually engage in personal judgement to arrive at an estimated value. Hence, there is need to employ the new approaches in estimating house prices for mass appraisal.

Furthermore, property tax is one of the major and important sources of revenue to the local government (Harris and Moore, 2013; Owuso-Ansah, 2012; Sipan, et al., 2012). However, this potential of property tax as a source of revenue has not been fully utilized particularly in Minna, despite its economic importance. Therefore, the selection of Minna for this study is closely related to the importance of the city as the capital of Niger State, Nigeria. Niger State is a neighbouring state to Nigeria's capital city, Abuja. Minna is located about 150km away from Abuja, and has over the years experienced continuous influx of people which has led to rapid increase in its population. However, this rise in population has not been accompanied by adequate infrastructural development. This may be due to the high expenditure the state government has to incur with the limited revenue that is gotten mainly from the federal allocation most of which is spent on recurrent expenditure.

Hence, real property tax is seen as one of the avenues through which the government can generate more revenues to finance its activities especially in terms of physical infrastructural development for the benefit of the populace. For this, there is need for a systematic real property tax administration system that will serve the interest of the government and people. It becomes very important to propose a more efficient way of assessing house prices by the local governments for the purpose of tax administration. This will ensure equity and uniformity, as well as fairness in the assessment process, both to the taxpayers and the local authorities. It will also lead to reduction in costs of property assessment as well as time saving. This has necessitated

the use of mass appraisal for taxation purposes, which will serve as a starting point to providing an effective tax system.

House prices are often influenced by a myriad of factors. The level of influence exerted by each of these factors differs across markets, property types and locations. What affects house price in one area might not necessarily be the same in another area. A lot of studies have employed the hedonic price model in estimating house prices and developing mass appraisal models, with the researchers arriving at different conclusions. It is therefore impossible to generalize the outcome (Abdulai and Owusu-Ansah, 2011). To this, Sirmans et al. (2006) noted that the estimated coefficients for some characteristics from previous studies vary significantly by geographical location. Hence, it is wise to conclude that each market or location requires a different study before any inference can be made.

Econometric models are useful approach to estimating home price to buyers and local authorities. Over the years, classical hedonic models in real estate appraisal have been used as a procedure to estimate prices of such complex goods as housing (Tabales et al, 2013). Presently, there is no any published research work applying the hedonic price model in house price estimation in the Minna housing market. This research is therefore motivated by the need to apply the approach in estimating house prices in the study area, with the aim of proving a suitable model for mass property assessment. The study is equally necessary to provide a basis for further research in this direction.

1.3 Research Questions

The study seeks to address the following questions:

1. What are the housing attributes that affect house price?
2. What are the significant housing attributes for mass appraisal model in the study area?

3. How effective is the use of hedonic pricing model in estimating house price for mass appraisal model in the study area?

1.4 Aim and Objectives

The aim of this research is to apply the hedonic approach in estimating house prices for mass appraisal model in Minna, Nigeria. The research has three fold objectives. They are:

1. To identify the housing attributes that affect house price.
2. To determine the significant housing attributes for mass appraisal model.
3. To develop mass appraisal model using hedonic approach for house price estimation.

1.5 Scope

The study will focus on developing mass appraisal model for residential properties. The study will be based on residential property transactions where secondary data will be obtained from registered estate surveying and valuation firms that handle property transactions in the study areas for the period of 5 years between 2009 and 2013. The scope of the study is defined to include housing attributes particularly the physical characteristics (floor area, house type, number of bedrooms, number of bathrooms, age of the building, year of transaction, and general condition of the house); locational attributes (geographical location and distance to the central business district, CBD), and neighbourhood attributes (i.e. availability of facilities in the neighbourhood). These attributes are considered likely to be value significant as evident in previous studies of this nature. Statistical approach particularly the multiple regression analysis will be utilized in the analysis of data. The geographical scope of the study is confined to Minna, the capital of Niger State, North-central Nigeria.

1.6   Methodology

The methodology adopted in this research involves both theoretical and empirical approach. The researcher has revisited literatures from previous studies on hedonic house price modelling and mass appraisal. Secondary data were collected from registered estate firms and SPSS was used to analyse the data and the research results were presented.

This research has been carried out in 3 basic stages. The first stage represents the theoretical aspect of the research work. It dwells on the identification of research issue, review of past literatures and formulation of aim and objectives for the present research. The purpose is to establish a theoretical framework for the research. This was followed by the second stage, which constitutes the empirical aspect of the research. In this stage, the study employs the use of statistical technique particularly the hedonic modelling approach to empirically identify the significant factors that affect house price in the study area and the level of effect exerted by each of the factors. These factors were then used to develop a mass appraisal model for residential properties in the study area. The last stage of the research involves evaluation of the developed model to test its suitability for the purpose of mass appraisal. This was done with the use of ratio study.

The analysis will involve regressing observed sales prices for the house against the house attributes which the researcher perceived to be determinants of the sales price. As mentioned earlier in the scope of the study, the attributes hypothesized to influence the price of a house include floor area, house type, number of bedrooms, number of bathrooms, age of building, year of transaction, condition of house, the geographical location of the house, its distance from the CBD and the neighbourhood facilities.

Therefore, the specification for the proposed hedonic price function can be stated as:

PRICE = f (TYPE, SIZE, ROOMS, BATH, AGE, YEAR, CONDITION, LOCATION, DISTANCE, FACILITIES)

Where;

PRICE	= Price of the house
TYPE	= Type of the house
SIZE	= Size of the house
ROOMS	= Number of rooms in the house
BATH	= Number of bathrooms in the house
AGE	= Age of the house
CONDITION	= Physical condition of the house
YEAR	= Year the house was sold
LOCATION	= Location of the house
DISTANCE	= Distance of the house to the CBD
FACILITIES	= Availability of facilities in the neighbourhood

The study flow chart is presented in figure 1.1 overleaf.

Research Issue
•Subjectivity of traditional methods of valuation.
•Insufficient evidence of comparable properties in the market.
•The need to realize the importance of real property tax as a source of revenue.
•Need to apply more efficient techniques for mass property valuation.
•Lack of studies on the development of mass appraisal model in the study area.

Research Aim
To apply the hedonic approach in estimating house prices for mass appraisal model

Research Objectives

| 1. To identify the housing attributes that affect house price. | 2. To determine the significant housing attributes for mass appraisal model. | 3. To develop mass appraisal model using hedonic approach for house price estimation. |

Data Collection

Literature Review

Secondary Data (Transaction Data)

Data Analysis

Content Analysis

-Descriptive statistics
-Correlation analysis
-Collinearity test

-MRA
-Test of model accuracy
(Ratio Study)

Expected Outcome

List of housing attributes affecting house price

List of significant housing attributes affecting house price
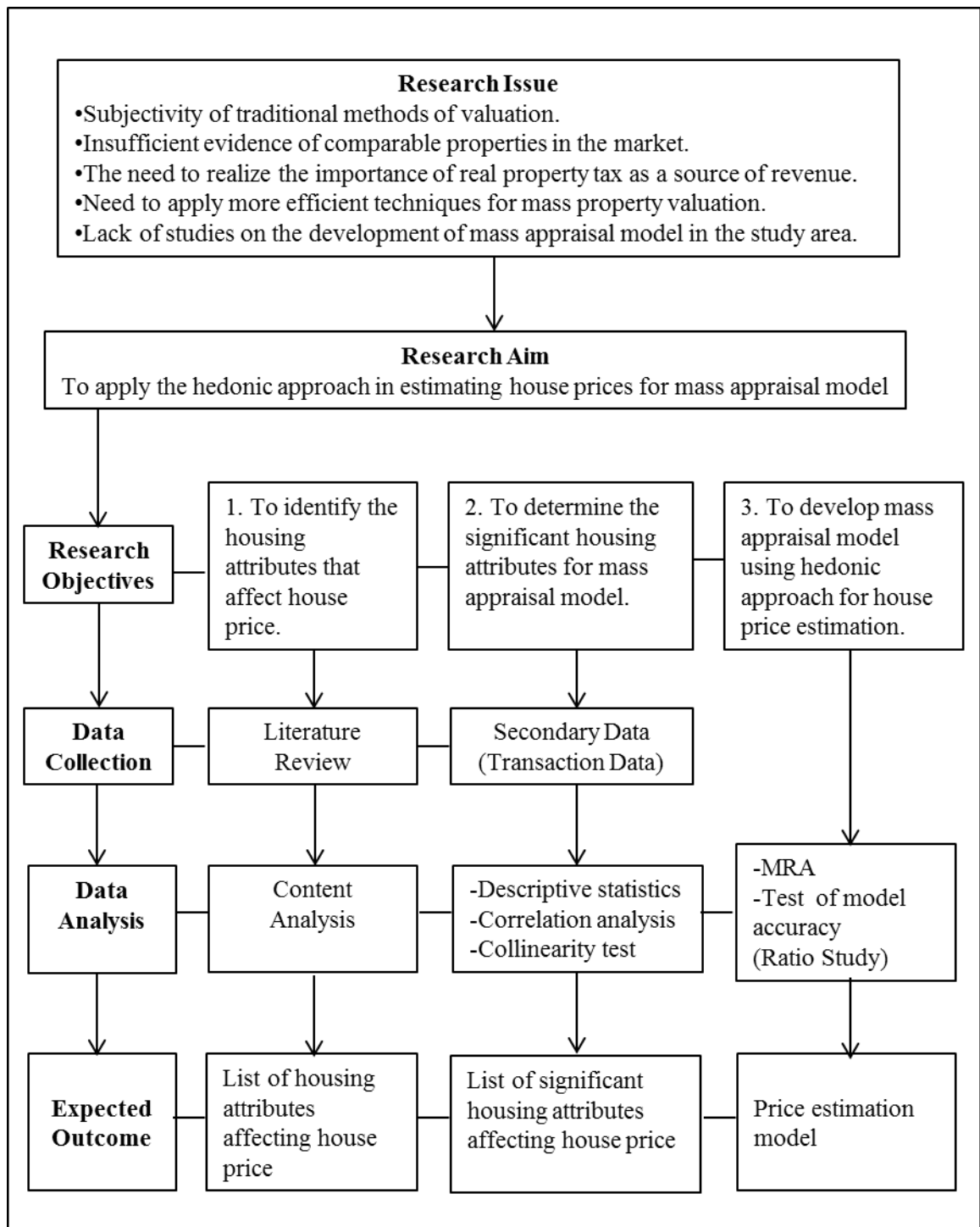
Price estimation model

Figure 1.1: Study Flow Chart

1.7   Significance of the Study

The importance of housing and the study of housing cannot be overemphasized. Establishing the relationship between housing attributes and price will be of significance to different market players as it will ease the process of estimating house prices. Housing can serve as a source of real property tax revenue to the government. Thus, this research work will assist the local authorities in mass appraisal of properties for rating purposes. Property valuers will find it easier to value large group of houses by using the hedonic model for mass appraisal, which is expected to improve the objectivity, efficiency and accuracy of the valuation process.

Furthermore, the knowledge of hedonic models could be used by real estate developers and marketers in developing a suitable marketing plan which will be guided by the identified attributes that appeal to the target customers in a particular market, given the nature and type of the development. Identifying these attributes will give developers an idea of what the customers desire and are willing to pay for in a house.

Finally, the study will help to improve literature on the application of hedonic house price models in developing countries like Nigeria. As mentioned earlier, due to lack of any published research on the subject matter in the study area, a research work of this nature is very important as it will provide a basis for researchers to carry out further academic investigations in the field.

1.8   Structure of the Thesis

This thesis is made up of five chapters. Brief descriptions of the contents of each of the chapters follow.

Chapter 1 provides an overview of what the research work sets out to achieve. It covers the introductory part of the research. This includes background to the study,

the problem statement, the research questions, aim and objectives, scope, brief methodology and significance of the research.

Chapter 2 deals with the theoretical framework of the research. It starts with explaining some basic concepts of property market and market value. This was followed by identifying the factors influencing residential property prices from previous research works. Furthermore, the chapter gives an overview of the hedonic price model and its application to house price studies. Finally, the concepts of mass appraisal and ratio study were discussed in the chapter.

The third chapter describes in detail the methodology adopted in the study, including the sources of data and methods of data collection as well as analysis. It also contains description of the study area and a general overview of the property market in Nigeria and the study area in particular.

Chapter 4 covers the analysis and empirical aspect, which dwell on examining the relationship between housing attributes and house price. The extent to which the former affect the latter in the study area was examined using econometric approach. Furthermore, a hedonic model was developed and the suitability of using the model to estimate house price for mass appraisal in the study area was also evaluated using the appropriate measures of mass appraisal performance.

Chapter 5 is the last chapter of the thesis. It provides a summary of the research findings. The limitations of the research were stated in the chapter and useful recommendations were made as well as suggestions for further research. The research report ends with a conclusion.

1.9   Conclusion

This chapter has provided an overview of the research work starting with a general background on housing and a description of the issue being researched. This was followed by formulation of research questions, aim and objectives of the study. The scope of the study was defined and a brief explanation of the methodology was given. The chapter also explained the importance of carrying out a study of this nature. Finally, the sequence of the chapters in the thesis were presented.

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