REAL ESTATE FORECASTING MODEL FOR RESIDENTIAL MARKET IN NIGERIA

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DEDICATION

This thesis is dedicated to my late brother, Dr. Yaya Saidu Alkali (Danmasanin Dukku) my second father, for his support, encouragement, advice and prayers which guided me through this achievement. I'am proud of him for becoming the giant pillar of unity among the entire Banu Alkali Saidu Family. May Allah reward him with Jannatul Firdausi amin.

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ABSTRACT

Real estate residential sector is the most influential sector among the other sectors in built environment. Houses are essentials to human beings and thus impacted the residential property sector in terms of demand and supply. This in turn would potentially cause price fluctuation on the residential properties. The potential increase in residential price would affect the general economy as well as the quality of life. Nigeria has witnessed progressions in residential property and thus needs to be systematically managed to minimize the negative impacts on the people. This includes identifying internal and external factors that could contribute to the volatility of house price in Nigeria especially in the capital city of Abuja. This research aimed at developing a residential property forecasting modelling that covers different property types within Abuja city, Nigeria. Secondary data was used in this research which includes Abuja residential sales price and macroeconomic data such as as Gross Domestic Product, Interest Rate, Consumer Price Index, Exchange Rate, Crude Oil Price and Household Income. The Box-Jenkins Auto Regressive Integrated Moving Average (ARIMA) and Exponential Generalized Auto Regressive Conditional Heterokedasticity (EGARCH) modelling were used in analysing the data. The findings indicate strong and positive correlation between consumer price index (CPI) and exchange rate with the prices of 2,3,4 and 5-bedroom flats in Abuja. On the other hand, interest rate shows a strong negative relationship with all the four categories of residential properties in Abuja. The findings also indicate that there is volatility in residential prices and it varies from one category to another. The leverage effect was only found in the prices of 2 and 3-bedroom flat in Abuja. The potential of forecasting quarterly residential prices in Abuja shows that the forecasting trend follows the actual price closely through-out the sampling period, while the post sample period forecasted the future residential price for five years from 2018 first quarter to 2022 fourth quarter in which ARIMA (4,1,1), ARIMA (1,1,1), ARIMA (8,1,1) and ARIMA (1,1,6) models were developed. The forecasted price shows volatility in the price of 2 and 3-bedroom flats with 100% increase. At present, the real estate price forecasting in Nigeria is based on traditional method which lacked in acceptable standard and process of certification. Therefore, this research has developed ARIMA forecasting model of real estate residential property market in Abuja, which is the first of its kind in Nigeria and Africa. Generally, ARIMA provides effective forecasting model for residential properties in Abuja for a better understanding of its residential price dynamics. It also managed to show that increasing residential price has impacted the general economy.

ABSTRAK

Sektor harta tanah kediaman adalah sektor paling berpengaruh di antara sektor alam bina lain dalam kehidupan manusia. Rumah adalah keperluan untuk manusia dan dengan itu memberi kesan kepada sektor harta tanah kediaman dari segi permintaan dan penawaran. Ini seterusnya berpotensi menyebabkan turun naik harga hartanah kediaman. Potensi peningkatan harga kediaman akan memberi kesan kepada ekonomi dan juga kualiti kehidupan individu. Nigeria secara progresif menyaksikan perkembangan dalam harta kediaman dan oleh itu perlu diuruskan secara sistematik untuk meminimumkan kesan negatif terhadap rakyat. Ini termasuklah dalam mengenal pasti faktor dalaman dan luaran yang boleh menyumbang kepada turun naik harga rumah di Nigeria terutama di bandaraya Abuja. Kajian ini bertujuan untuk membangunkan model peramalan harta kediaman yang merangkumi pelbagai jenis harta benda di bandar Abuja, Nigeria. Data sekunder digunakan dalam kajian ini termasuk harga jualan kediaman Abuja dan data makroekonomi seperti kadar keluaran dalam negara kasar (KDNK), Kadar Faedah, Indeks Harga Pengguna, Kadar Pertukaran, Harga Minyak Mentah dan Pendapatan Isi Rumah. Pemodelan Box-Jenkins ARIMA dan EGARCH digunakan untuk menganalisis data. Penemuan ini menunjukkan korelasi yang kukuh dan positif antara indeks harga pengguna (CPI) dan kadar pertukaran dengan harga rumah flat dengan 2,3,4 dan 5 bilik tidur di Abuja. Sementara itu, kadar faedah menunjukkan hubungan negatif yang kuat dengan semua 4 kategori harta kediaman di Abuja. Penemuan ini juga menunjukkan bahawa terdapat turun naik harga kediaman dan ia berbeza dari satu kategori ke kategori lain. Kesan yang dimanfaatkan hanya didapati dalam harga flat 2 dan 3 bilik tidur di Abuja. Potensi dalam meramalkan harga kediaman suku tahunan di Abuja menunjukkan bahawa trend ramalan mengikuti harga sebenar sepanjang tempoh persampelan, manakala tempoh sampel pasca meramalkan harga kediaman pada masa hadapan untuk lima tahun dari suku pertama 2018 hingga 2suku keempat 2022 dimana ARIMA (4,1, 1), ARIMA (1,1,1), ARIMA (8,1,1) dan ARIMA (1,1,6) telah dibangunkan. Harga yang diramalkan menunjukkan turun naik harga rumah 2 dan 3 bilik tidur dengan peningkatan 100%. Pada masa ini, ramalan harga harta tanah di Nigeria adalah berdasarkan kaedah tradisional yang tidak mempunyai piawaian dan proses pensijilan yang boleh diterima. Oleh itu, kajian ini telah membangunkan model peramalan ARIMA bagi pasaran harta tanah kediaman di Abuja, yang merupakan pertama kali berlaku dalam konteks Nigeria dan Afrika. Secara amnya, ARIMA menyediakan model peramalan yang berkesan untuk harta tanah kediaman di Abuja dan ia juga memberikan pemahaman yang lebih baik mengenai dinamik harga kediaman. Ia juga berjaya menunjukkan bahawa peningkatan harga kediaman mempunyai kesan terhadap ekonomi.

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LIST OF ABBREVIATIONS

ADF	-	Augmented Dickey Fuller
ARIMA	-	Autoregressive Integrated Moving Average
ARIMAX	-	Autoregressive Integrated Moving Average with Exogenous Variables
AR	-	Autoregressive
ANN		Artificial Neural Network
CBN	-	Central Bank of Nigeria
COP	-	Crude Oil Price
CPI	-	Consumer Price Index
EGARCH	-	Exponential Generalized Autoregressive Conditional Heterosdasticity
ER	-	Exchange Rate
FCT	-	Federal Capital Territory
GARCH	-	Generalized Autoregressive Conditional Heterodasticity
GDP	-	Gross Domestic Product
HI	-	Household Income
MA	-	Moving Average
MRA	-	Multiple Regression Analysis
NIESV	-	Nigerian Institution of Estate Surveyors and Valuers
REEP	-	Real Estate Residential Price
UTM	-	Universiti Teknologi Malaysia
NBS	-	National Bureau of Statistics
NIESV	-	Nigerian Institution of Estate Surveyors and Valuers

LIST OF SYMBOLS

x	-	Variable considered
α	-	Intercept
%	-	Percentage
$xt\text{-}i$	-	Previous values of the variable
p	-	Order of AR model
ut	-	White noise
q	-	Present value of variable
d	-	difference

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CHAPTER 1

INTRODUCTION

1.1 Background to the Study

Real estate market plays a vital role in people's fundamental needs as well as economic growth of a country through increased gross domestic product (GDP). Real estate market was the largest market in developed countries and globally, which was estimated as 30% to 40% of the value of all the hidden physical assets (Deaconu et al. 2015). Similarly, real estate sector in developed countries has been proven as major catalyst for economic growth which consequently these countries have strong macroeconomic background that reflect the performance of property market. Real estate market has high correlation with the market condition. Uncertainties in capital market will give significant impact to real estate market. Moreover, the current global credit crisis commence with the fall in the United States' real estate price index, which led the world's real estate sector into a cruel economic sprawl (Gupta et al. 2011; Mohd et al. 2016).

The international market has passed through uncertainties, due to the economic crises of 2008 and the markets are seen to be unstable even after 4 years, which led various researchers to examine and assess the sources and nature of the crisis such as mortgage and asset backed securities, bad regulations, credit avoidance swaps, high interest and low interest rates (Vishwakarma, 2013; Waldron, 2018; André et al. 2019). Moreover, in the aftershock of economic crisis, the growth and perception of residential property market became closely observed by local and global investors together with market competitors (Boitan, 2016). Modelling and forecasting is seen as a key enabler in the decision-making with respect to real estate investment. Accurate forecast of the future real estate prices is very significant (Wang et al. 2014). In many countries, residential property contributes significantly in the property market. Residential real estate market in the past few decades, has witnessed large recurring

discrepancies of volumes and prices among many industrialized countries globally (Nneji et al. 2013). The role of macroeconomic factors on real estate market able to give significant impact to the price condition which evidently can be seen in several countries. For instance the United Kingdom's real estate market in the year 1980, whereas financial liberalisation caused a boom in the price, but due to interest rates' increase in the early 1990s, residential real estate prices witnessed a quick decline (Begiazi, 2016). Moreover, United States also witnessed real estate prices increase by 61% between the years of 2000 and 2005 but declined sharply by 38% in the subsequent four years. Furthermore, other countries like Spain, Ireland and Japan has witnessed similar changes (Jones and Richardson, 2014).

The real estate cycles are often connected with macroeconomic drivers' changes such as economic growth and interest rates (Nneji et al. 2013). Macroeconomic changes can considerably determine the magnitude and directions of country's real estate price movements (Duan, 2018). Fluctuations of asset price usually has an effect on the real economy (Nguyen and Wang, 2010). Therefore, it can be concluded that macroeconomic factors play an important role in performance and development of real estate market. Despite the importance of real estate in economic development, its role is not sufficiently recognised (Ahuja et al. 2010). According to Grum and Govekar (2016); Gasparėnienė et al. (2016) majority of macroeconomic factors that are related to residential real estate price remain unknown.

Therefore, exploring the role of macro-economic factors is necessary in forecasting and understanding the behaviour of real estate market. Nigeria is a country that recently has played an active role in real estate sector which aim to contribute in nations' economic growth. The country is in the midst of a housing boom, primarily due to the great demand created by a rising population. Nigeria’s housing deficit is estimated to be 17 million as of August 2012 (NBS, 2015). Furthermore, Nigeria is making rigorous efforts to increase transparency in the property market. Resilient economic growth and the existence of some fastest emerging cities in Sub Saharan Africa such as Lagos and Abuja are helps in driving the demand for properties in every sector, as Nigeria strengthen its prestige as a main commercial centre of West Africa.

Moreover, Nigeria's real estate contracted a further 7.37% in the third quarter of 2016. Prior to Nigeria's economic recession, the real estate market was the fastest growing sector of the economy and outperformed overall GDP growth in 2013, growing at a rate of 8.70 percent, 1.30 percent above Gross Domestic Product growth of 7.40 percent, by 1.30 percent (Estate Review & Outlook, 2017). The real estate prices in major urban cities such as Lagos and Abuja has reduced by 16% in the second quarter of 2016 and it further reduced by another 23% at the end of the third quarter, making it about 39% decrease between the first and the third quarter of 2016. Moreover, real estate residential prices in Abuja experienced a lot of fluctuations across the 3 strata. Prices increased slightly in the first quarter of 2016 while it decreased in the second quarter of 2016 as well as the first quarter of 2017.

However, Nigeria as a political and economic hub of Africa, falls below its peers with regards to real estate investment, ownership and mortgage financing. The country has the lowest rates of real estate residential ownership in Africa with (25%) compared to Benin (63%), South Africa (56%) and Kenya (73%). This is further compounded by low mortgage financing, amounting to 0.5% of GDP compared with Ghana (2%) and South Africa (31%) (NBS, 2016). Consequently it gives impact in term of real estate database in Nigeria especially on real estate price index, which is required for compilation of national accounts and for the construction of a robust consumer price index, especially now that many countries are restructuring their policies to understand the causes of real estate bubbles and prevent it (Global Property Guide, 2017). Furthermore, in most countries, residential property market plays a major role in real estate development. The data base background is vital as it is able to give more accurate information in term of supply and demand to create equilibrium in residential property market.

Moreover, investors will be well-informed on the residential property growth in terms of investment opportunities. In addition forecasting model also will help in term of decision making as well as to establish a good policy for the stake holders. Developing a real estate forecasting model is necessary to understand the time series of different real estate residential types in Nigeria. Forecasting real estate price requires a model that can be able to provide efficient and accurate forecasting (Sarip

et al. 2016). House price index together with price forecasting able to give information such as price, yield and rents within a determined time setting. Therefore, stakeholders with loan portfolio, such as those secured property market, requires fairness and transparency in analysing the future movement of real estate market. (Brooks and Tsolacos 2010). Forecasting real estate prices is essential under the market economy to implement the apparent regulation efficiently (Wang et al. 2014). Finally, models that forecast real estate price can provide a plan for decision makers on the prospect of the overall macro-economy and can offer significant information for planning better and more suitable policies, because real estate sector act as a key indicator of the nation's economy.

1.2 Problem Statement

The influence of macroeconomic factors on residential real estate price in Nigeria has not been established. Previous studies focus mainly on rental values to residential properties such as done by (Olatunji et al. 2017). Studies on residential property market and its future is seen to be undeveloped, in terms of country coverage. In general, Nigeria's real estate market was also affected by macroeconomic factors such as, increasing unemployment, economic recession, high inflation, high interest rate and insecurity which causes low demand and declined in residential real estate prices. Nevertheless, no empirical study has been done to investigate this general perception. The housing price in Nigeria increased at an average inflation rate of 50.1% for lease properties and 39.3% for sale properties. Nigeria faced the worst housing shortfalls in the history with real estate ownership of lower than 20% and a housing shortfall higher than 30 million. The deficit caused poor living standards, excessive housing price, huge mortgage expenses, abandonment, disease epidemic, disrepair, and high cost of maintenance. Moreover, the development achieved in the Real Estate market in Q3, 2015 was 2.07%, less than the development achieved in the Q3, 2014, and also less than achievement of Q2, 2015 by 3.95 % and 0.94% separately. The property market sector provided 8.57% in real terms to the total Gross Domestic Product in the last part of 2015.

Therefore, in order to establish the confidence level as well as increase the transparency level of residential property sector in Nigeria, it is vital to determine and assess the impact and relationship of macroeconomic factors on residential property price in Nigeria, specifically in Abuja. According to Newell (2016); Abidoye and Chan (2016) there is lack of logical and extensive research on African property markets as well as irregular information in the Nigerian real estate market, which lead the inconsistency in the price of residential properties within the same location. However, it clearly reveals that Nigerian real estate market is undeveloped which correspond with the opaque categorization of global standard measure of transparency in real estate market. Presently, the prediction of real estate price in Nigeria, is based on traditional method, which lacked an acceptable standard and certification process. Therefore, development of real estate price model will help in filling an important gap and will provide information on the future price of different type of residential properties.

Moreover, previous research on the relation between real estate and the macro-economic variables focused on the experience of developed nations like United States and United Kingdom, however, the characteristics of real estate markets in developing economies, as well as the relationship with macroeconomic variables have not yet been thoroughly researched (Ciarlone, 2015). The relationship between macro-economic variables with the real estate residential price differed depending on the observed environment and therefore the outcome of individual studies might not be generalized to other countries due to diverse economic background and environment. With this problem statement background, it is important to assess the impact of macroeconomic factors on residential property price in Abuja, Nigeria. The unsteady relationship between real estate market and the economy has negative impact on the real estate market returns in Abuja (Wahab et al. (2017).

This research concentrated on the Abuja residential property market that has not been fairly covered regardless of its size. However, most of the research carried out on real estate market in Nigeria has concentrated mainly on commercial or rental values of residential properties. The majority of research on real estate market in Nigeria focuses mainly on Lagos the former capital of Nigeria. To achieve sustainable

real estate investment, there is a need to cover other part of the country. It is evident, real estate forecasting models have not been generally adopted in Nigerian real estate market. Such research when carried out will fill the gap and simultaneously will outlined the best real estate price forecasting model in Nigeria. The available literature shows an increasing recognition on the benefit of real estate forecasting modelling. Previous studies have been able to carry out forecasting of real estate residential prices using Box Jenkins ARIMA modelling. This implied that the outcome of previous studies regarding forecasting modelling of real estate market is inconclusive. However, according to the available literature, ARIMA modelling techniques was broadly accepted for real estate price appraisal by various scholars in real estate markets across the globe and was employed in various field of research in Nigeria, even with its recognition in this field, the propensity of its application in Nigerian real estate market and Africa in general is unknown and has not been recognized.

Moreover, volatility is the most significant research area in economic and finance. Estimating, modelling and forecasting volatility plays an important role in risk management, portfolio selection, and real estate pricing (Weng and Gong, 2017). Moreover, according to Savva and Michail (2017) real estate price volatility increases general risk in the economy. Similarly according to Al-najjar (2016) increase in real estate price volatility can reduce stability of macro economy and can increase systemic risks of mortgage and banking sectors, because they are susceptible to fluctuation in the property market due to their exposures, Therefore, volatility was considered as measure of uncertainty for changes in asset prices. Similarly, volatility reveal market's uncertainty and the capability to model and forecast volatility is significant for security pricing, risk and portfolio management (Lee, 2009) and (Aboura and Wagner, 2016).

Generally, negative information increases volatility in real estate market more than good one. The news replicate, also depend on the economic condition where bad information raises volatility more in good time than bad one, while good information raises volatility more in bad time than good one. More so, Dahmardeh and Khaki (2018) affirmed that negative information has impact on real estate price fluctuation more than positive information. Despite the fact that, financial assets' volatility has been broadly researched, there is limited research on the impact of negative

information on the real estate market volatility. Therefore, it is very important to determine the effect of negative information on the volatility of residential property price in Abuja, Nigeria.

1.3 Research Gap

It is essential to develop a robust and reliable real estate forecasting model to monitor the actual real estate market trend for boosting real estate investment in the country. According to Kamarudin et al. (2014); (Oloke, 2017) forecasting models are important for scholars to explain various circumstances that arise from the real estate market. As real estate market varies, the nature of models varies as well. Therefore a model can work in one condition but not in any. Because each real estate market has its rules, network and business culture, whilst experience in one market may not be generalized to another. Thus developing forecasting model in real estate studies is incessant process therefore, it may take various methods. Moreover, significant literature in this field is still limited and few empirical research has tried to forecast real estate price using univariate time series analysis.

This research is an attempt to fill the gap by developing a real estate forecasting model in Abuja Nigeria, this would provide a basis in fixing the standard price for real estate residential properties by the real estate developers and investors and it enhanced the efficiency of residential property market in Abuja, Nigeria as well. Moreover, accurate forecasting of real estate residential price is significant to the potential homeowners, investors, tax assessors, real estate developers, appraisers, and other participants of property market such as, primary mortgage institutions and insurers. Presently, the real estate price prediction in Nigeria, is based on cost and sales comparison which lacked an acceptable standard and process of certification. Therefore, development of real estate price model helps in filling an important information gap and provides residential real estate price information as well as improved the efficiency of the real estate residential market in Abuja, Nigeria.

However, assessments and forecasting of real estate market can provide understanding of the fundamental sustainability of real estate market and construction (Han et al. 2018). Similarly, the macroeconomic factors' influence on residential real estate price in Nigeria has not been established however, the studies investigated the macroeconomic factors' influence on rental values only and they found that macroeconomic factors has significant influence on the property return (Olatunji et al. 2017). Moreover, (Wahab et al. 2017) opined that, fluctuation of returns in the real estate market has been a major source of concern among real estate investors in Nigeria. There is a need to study the residential property market performance based on macroeconomic factors in Nigeria, because previous studies focused on microeconomic factors such as neighbourhood, location and physical factors. Furthermore, the impact of macroeconomic factors on real estate price received inadequate attention. There is limited research on the impact of macro-economic variables on the real estate prices analysis within a city or region (Zhang et al. 2016); (Gasparėnienė et al. 2016); (Grum and Govekar (2016). Moreover, there is growing need for real estate investors, banks and construction companies to relate property market investment with the Nigeria's economic market, because they underrate the need to study the impact of macroeconomic factors on real estate residential market as well as real estate market efficiency in Nigeria. This will have adverse effect on the Nigerian property market and it will conversely affect the real estate sector's contribution to the national economic development (Wahab et al. 2017).

Furthermore, forecasting house price movements is a challenge, therefore more research is needed to establish a dynamic correlation between real estate market and macro variables (Jadevicius and Huston, 2015). More so, Begiazi and Katsiampa (2019) claimed that there is limited studies on modelling and forecasting the price of different residential property types and its essential to forecast each residential property type separately because they are being used for different purpose and they attract different types of investors as well. This research attempted to fill the existing gap that previous research did not cover forecasting modelling of different type of residential properties within a city. However, according to Bollerslev et al. (2016) previous studies consider only residential price indices in developing the forecasting model however, the house price index construction is overwhelmed by two major problems. Firstly, residential properties are heterogeneous assets which make them to

be unique, in terms of features, location and maintenance level which affect the price. The goal of house price index was to measure the price trends of a hypothetical house of average quality, with the presumption that average quality of a house remain constant all the time. However, in reality, average quality of a house keep increasing all the time. Secondly, repeat sales index manipulate information only from residential properties that were sold twice through the sampling time. Therefore, a category of houses may not represent the whole housing market, which may result in sampling selection bias. Therefore this research attempted to fill the gap by considering the actual house price in developing the forecasting model for residential property within Abuja city.

However, according to Tan et al. (2017) real estate market is susceptible to the international financial volatility. Increased in real estate price volatility can reduce macroeconomic stability and will increase total risks in the mortgage and banking sectors. Although previous studies provide confirmation of real estate price volatility in developed countries, there is lack of evidence from developing countries (Savva and Michail, 2017). Moreover, examining the volatility in real estate price will offer several vital information regarding the level of real estate price dynamics in a country and specially risk return characteristics of real estate prices (Coskun, 2016). Therefore to develop efficient real estate market where vulnerable investors will be fully protected from real estate price volatility, there is a need to fill the research gap, by determining the effect of negative information on the volatility of residential property price in Abuja, Nigeria to tackle real estate market volatility.

Measuring volatility of real estate price is essential in understanding the dynamics of real estate price risk. It was observed that volatility spreads from small to bigger housing units (Zheng, 2015). André et al. (2019) explores asymmetry of residential price in US, using linear models and they found that residential property prices are asymmetric in most circumstances which implied that linear models are insufficient to capture the real estate price volatility and the leverage effect. Moreover, according to (Razali, 2015) negative information has a great influence on the volatility of residential price than a positive one. When investors lack information about the market situation they will take decision based on their gut feelings which will cause

imminent fluctuation of real estate price. Moreover, according to Chand et al. (2012); Razali (2015); Hung and Anh (2018); Guirguis (2018); Lee and Lee (2018) ARCH and GARCH models cannot capture the asymmetry or leverage effect of the volatility in time series concerning previous shocks, it can be captured only with EGARCH model. Therefore, this research attempted to fill the gap by employing EGARCH model to determine the effect of negative information on the volatility of residential property price in Abuja.

1.4 Research Questions

1. What are the macroeconomic determinants of residential property price in Abuja, Nigeria?
2. What is the relationship between the macro-economic variables and residential property price in Abuja, Nigeria?
3. What is the effect of negative information on the volatility of residential property price in Abuja, Nigeria?
4. What is the best forecasting model of residential property price in Abuja, Nigeria?

1.5 Research Aim and Objectives

The aim of this research is to develop a real estate residential property forecasting model that covers different property types within Abuja city. To achieve the above mentioned aim, the following objectives were outlined as follows:

1. To determine the macroeconomic variables that influence residential property price in Abuja, Nigeria.
2. To examine the relationship between macroeconomic variables and residential property price in Abuja, Nigeria.
3. To determine the effect of negative information on the volatility of residential property price in Abuja, Nigeria.
4. To developed forecasting model of residential property price in Abuja, Nigeria.

1.6 Scope of the Research

The research concentrates on residential property types in modelling and forecasting time series together with macroeconomic variables in Abuja city. The period of case study ranges from the first quarter of 2000 to the last quarter of 2017. The period of 17 years with a sample of 71 observations, which is considered sufficient to develop ARIMA model. However, according to Brooks and Tsolacos (2010) there is no appropriate sample size for model estimation, the researcher can only work with what is available at hand. But some scholars suggested at least 30 observations are required to estimate even the simplest model and at least 100 is desirable. This research covered different type of residential properties such as 2 bedroom, 3 bedroom, 4 bedroom and 5 bedroom within Abuja city. According to Boitan (2016); Grum and Govekar (2016) the heterogeneous character of real estate prices across a city has to be considered because investment rates was high at capital cities.

Subsequently, real estate price in the capital cities varied with other cities and it was the real estate prices in the capitals that created the real estate market and the research in that area is lacking. Therefore this justified choosing Abuja as the study area. Furthermore, majority of the research conducted on Nigerian real estate market focused mainly on Lagos, therefore to achieve a sustainable real estate investment, there is need to carryout forecasting of real estate price to cover other part of the country (Abidoye and Chan, 2017). This research is an attempt to fill the gap by providing a model for forecasting real estate residential market in Nigeria and also justified choosing Abuja (FCT) as the Nigerian Capital.

1.7 Significance of the Research

This research focused on time series analysis of residential property types within Abuja city. This provides good understanding of the dynamics of residential price. The research findings help investors and professionals with expertise in the real estate industry to contribute their quota in developing real estate, infrastructure and urban development. Forecasting model of residential price able to give decision takers an idea regarding the future tendency of the overall macroeconomy and consequently,

can supply important information for planning enhanced and appropriate policies. The developed models help to provide accurate forecasting of residential price which is vital to tax appraisers, prospective house owners, investors, developers and other stake holders to make investment plans. Furthermore, it able to help investors to value prices, rents and yield within a scheduled time framework. It also help the investors to maximise profits gained, however prospective buyer obtain the basic knowledge of the latest price movements. Consequently, it allow them to make well-versed decisions to avoid the risk of loss.

Moreover, it gives important benefit for governments to have a reliable forecasting model of real estate residential prices, to develop a sustainable housing delivery and prevent bubbles. With real estate forecasting models, investors could maximise profits gained, though potential buyers obtain the essential understanding of the most recent price movement that enable them to make decisions and reduce the risk of damage (Wang et al. 2016). Bork and Møller (2016) affirmed that, fluctuation of property prices have key effect on financial strength, business cycles and household welfare. Producing accurate real estate price forecast is very important for economic agents, Central Bank and financial supervision establishments. The empirical study develops a residential price forecasting model that employed ARIMA modelling technique, which was the first of its kind in Nigerian property market and Africa in general and it provides an outline of the residential price forecasting instrument in Nigeria.

1.8 Research Flow

Objective number 1 aim to discover the macroeconomic variables that influence residential property price in the study area. Therefore, extensive literature review was employed to determine macroeconomic variables that influence residential property price in Abuja and content analysis was adopted to analyse the collected data. To achieve Objective 2 which aimed to examine the relationship between the macro-economic variables and real estate residential property price in Abuja, Nigeria. Macroeconomic data was acquired from the website of Central Bank of Nigeria (CBN), which include (GDP, interest rate, consumer price index, exchange rate, crude

oil price & household income). While the data of residential property price was obtained manually from Estate Surveyors practicing in Abuja and the Nigerian Institution of Estate Surveyors and Valuers (NIESV) secretariat, Abuja. The data was obtained from the first quarter of 2000 to the last quarter of 2017. Therefore correlation analyses and automatic ARIMA forecasting modelling was employed to examine of relation between the macroeconomic variables and the residential property price. This objective helps in determining the relationship that existed between real estate residential price and the macroeconomic variables through Correlation analysis technique as well as the influence of macroeconomic variables on real estate forecasting model. To achieve Objective number 3 which aimed to determine the effect of negative information on the volatility of residential property price in Abuja, Nigeria. This objective was achieved using EGARCH with Eviews 10.

To achieve Objective number 4 which aimed to develop a forecasting model for real estate residential property that uses time series techniques, based on the findings in objective number 2 to get accurate results in forecasting residential property price in future. The objective was achieved by forecasting real estate changes and developing a forecasting model using residential price data from 2000Q1 to 2017Q4. Therefore objective 4 was achieved using, Box-Jenkins ARIMA method with Eviews 10 in forecasting the price changes of different types of real estate in Abuja as well as providing forecasting model. The ARIMA models was confirmed as an excellent short term forecasting models for a large variety of time sequences as short term features are projected to change gradually ARIMA models are established to be able to point out direction of short term market (Tse, 1997). ARIMA modelling performed well compared to other forecasting models as examined with details in literature review. The summary of the research flow was presented in Figure 1.1.

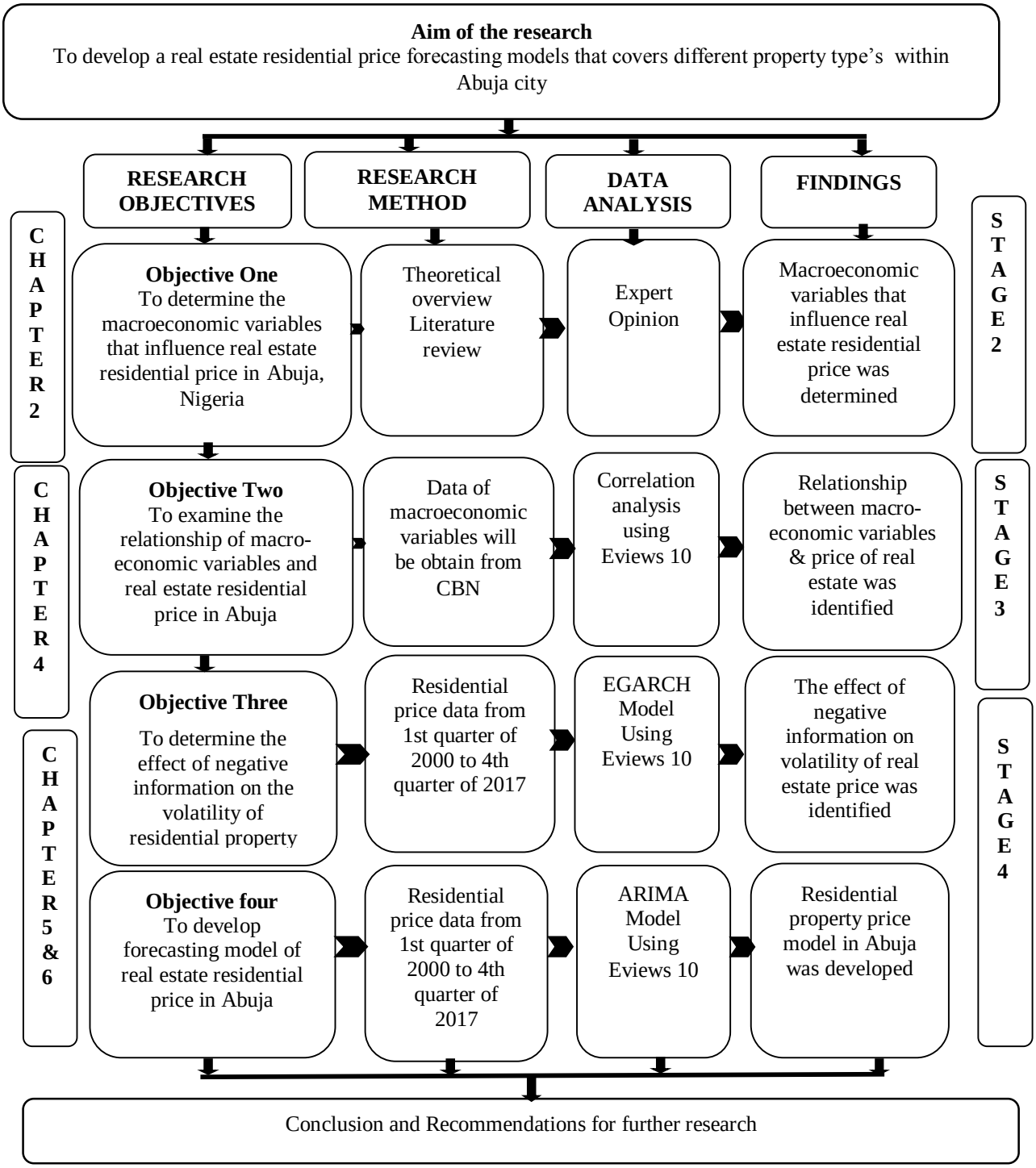

Figure 1.1 Research Flow

1.9 Thesis Organization

The writing of the thesis was organized into seven chapters. Each chapter was discuss in details and more specific to every section as per below:

Chapter 1: This chapter introduces the subject to be discussed. The chapter comprises research background which lead to the formation of the research problem, research questions and objectives of the research, research scope and the significance of the research. Moreover, it lays the basis for the rest of discussion that follows.

Chapter 2: The review of related literature presents an overview and justification to the necessary and makes this subject as basic research in finding answers to questions that arise. The chapter discusses the related terms about the research such as, r, real estate forecasting models, Box-Jenkins ARIMA Approach, data for quantitative real estate, time series analysis. The last part discusses the relationship between real estate price and macroeconomic variables, an overview of Nigerian real estate market. The next chapter presents research design and methodology.

Chapter 3: This chapter discusses the research framework and methodology. It discusses the real estate forecasting models. The six steps methodology of Brooks and Tsolacos, 2010 was discussions in details. The steps include statement of research problem, collection of data relevant to the model, choice of estimation method, diagnostic test for residuals, model evaluation and lastly, out of sample forecasting. More so, the chapter also discussed the EGARCH methodology used in determining the effect of negative information on the volatility of residential price in Abuja, Nigeria.

Chapter 4: This chapter presented analysis on the relationship between real estate residential price with macroeconomic variables (GDP, interest rate, inflation rate, exchange rate, crude oil price and household income), using correlation analysis with (Eviews 10). Moreover, the chapter presented analysis on the impact of macroeconomic variables on the real estate residential price forecasting models in Abuja.

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