On the Development of Residential Property Price Indices for Nigeria[1]

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This work focuses on the development of house price indices for Nigeria, and the estimates of the Nigerian Residential Property Price Indices on housing characteristics are presented. Four main methods of index construction were considered, these are hedonic regression, repeat-sales, stratification and central price tendency methods. It was discovered that econometric methods like hedonic and repeat sales were constraints in constructing residential property price indices for Nigeria by the nature of the data available. Hence, the central price tendency and the sale-based stratification methods which are internationally used measures were applied to the available zonal-level dataset from a survey of selected urban cities from the six geopolitical zones of the country. While the central price tendency was used to track changes in the price of the median residential dwelling sold from one period to another and the zonal shares of residential property prices, the sale-based approach was used to estimate the trends in the year-on-year growth rate of residential property price indices and the zone-wise price indices. On the whole, the results show a reflection of changes in the composition of residential dwellings sold in Nigeria from 2010 to 2012. The need for housing policy that will empower a comprehensive documentation of all attributes of price determinants for evaluation of residential property in Nigeria was emphasized.

Keywords: Central price tendency; Growth rate; Real estate market; Residential property price index; Sale-based stratification method.

JEL Classification: C43, C81, D11, E31

1.0 Introduction

Real estate has continued to play a substantial role in man's development. In recent time, investors in Nigeria have begun to explore strongly into real estate marketing and investments which often represents the single largest investment according to Davis and Palumbo (2008), and accounts for the

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largest share of wealth in most nations' balance sheets, according to Baldwin *et al.* (2010). In what follows, analysts, policymakers, and financial institutions have developed keen interest in following the trends in house prices to expand their understanding of real estate and credit market conditions, as well as to monitor the impact on economic activity, and financial stability and soundness, as mortgage lenders used information on house price inflation to gauge default risk (see, for example, Alterman *et al.*, 1999; Bostic *et al.*, 2009*;* Campbell and Cocco , 2007; Carare and Stone, 2003). In other words, understanding the pattern and nature of residential property price dynamics has become an important element in assessing the macroeconomic situation and outlook of the country, especially as the bursting of housing bubbles in a number of euro area countries and the United States has been a key contributing factor to the recent global financial crisis.

In an ideal world, a residential property price index (RPPI) would be constructed by reference to the current and historical market prices of the entire stock of residential dwellings, but in practice, market prices for any particular period are only available for those dwellings that are actually traded (sold/purchased) in the period. Such sales account form only a very small proportion of the total housing stock in any quarter and are therefore necessary to draw inferences about the price behaviour of the whole stock from these small samples. The assumption behind this procedure is that the median sales price of the houses traded each quarter is indicative of the median price of all houses, and the standard procedure for constructing price indices is to select a sample of representative items and to re-price the identical items over time.

Nigeria is among the countries in the world that are yet to have a comprehensive housing database. This, of course, has a negative effect in constructing its monthly or quarterly house price indices, which are needed for National Accounts compilation, and for the construction of a robust consumer price index especially now that governments around the world are cautious and also structuring policies in a way to tackle a crisis that might be caused due to real estate bubbles, as well as understanding the timing and causes of the bubbles (Velpuri and Pinna, 2012).

The intent of this paper therefore is to construct preliminary estimates of Nigerian residential property price indices as a critical first step in monitoring price volatility in the residential property market given that housing bubbles

may decrease growth returns in investments and put government policies under severe scrutiny.

Looking from the perspective of the Central Bank of Nigeria macro prudential regulation policy for financial stability or soundness, it also follows that the regulatory policy allows for a wide variety of surveillance techniques to become part of the instrumentation against banking crises, which implies both qualitative and quantitative aspects of the financial system being monitored so that tools such as early warning signals will form a component of the surveillance regime. This surveillance could be distinguished at a micro bank level as monitoring of variables relating to bank balance sheet health as well as measures of their income and expenditures, or at a systemic level as monitoring and tracking aggregate variables such as non-financial sector debt, interest rates and asset prices. Two crucial alternatives are available to policy makers in this respect: first, the central banks only responds to asset price misalignments if they alter the path of central bank targets (inflation and the output gap); and second, in recognition of the social costs of asset price corrections, central banks should counteract the accumulation of asset price imbalances irrespective of whether they are likely to impact on the short-term paths of inflation and output. The second alternative, which requires central banks to "lean against the wind" of asset price bubbles still remains an open problem in Nigeria.

Moreover, since the global financial and debt crisis has drawn increased attention towards modern banking regulation and surveillance during asset management, the need for a comprehensive real estate indices that will provide a full picture of the changes in the real estate market and the house prices during real estate management as highlighted in this paper could not be over emphasized. Section two of the focused on related literature on residential property price index construction, while subsequent sections include the methodology used in this study, the possible results obtained, the implication of developing residential property price indices for Nigeria and the concluding remarks.

2.0 Literature Review

The issue of housing bubbles, banking crises and monetary policy returned to the fore with the subprime crisis, where the financial crisis in countries such as the U.S was triggered by the collapse of house prices, operating domestically via losses on banks' balance sheet and globally via securitized

housing loans (Davis *et al.,* 2011). A report by the U.S. Congressional Budget Office (2007) showed that during the house prices surge of the 1990s and 2000s, consumer spending grew faster than incomes. Thus, household wealth effects generally lead to increases in spending by consumers on home renovations and repairs in addition to increased spending on other goods and services. The connection between the house prices and banking crises was first established in the seminal work of Kaminsky and Reinhart (1999). Since then, specific linkages between house price dynamics and banking crises have been discussed inter alia by Reinhart and Rogoff (2008), and empirically quantified by Barrell *et al.* (2010a).

As a case in point, there have been recommendations by financial regulators to focus on housing indicators from an early stage in the development of macro prudential surveillance (Davis *et al.,* 2011). Such recommendations include the monitoring of residential house prices down to a sectoral level due to the high concentration of banks' asset portfolios in this market and their exposure to boom and bust cycles which motivated the need for this study as a critical first step to accomplish this task.

The October 2009 Report to the G-20 Finance Ministers and Central Bank Governors on the Financial Crisis and Information Gaps described data on residential dwellings and their associated price changes as critical ingredients for financial stability policy analysis (IMF, 2009). This is because central banks often relied on movement in house price indices to monitor households' borrowing capacity and debt burden, and their effects on aggregate consumption, for monetary policy formulation (Diewert, 2009a; Finocchiaro and Queijo, 2007).

There are many areas of society where individuals or organizations used residential property price indices (RPPIs) directly or indirectly either to influence practical decision making or to inform the formulation and conduct of economic policy (Gudnason and Jónsdóttir, 2009; Gelfand *et al.,* 2004). But the idea of a more detailed research on property price indices dates back to a workshop organized by the Organization for Economic Cooperation and Development (OECD) and the IMF on Real Estate Price Indexes in Paris, November 2006 (Diewert, 2009b).

Reports from IMF (2006) and Australian Bureau of Statistics (2006) showed that the national central bank of Austria worked jointly with the Vienna

University of Technology to develop and compile residential property price indices that were based on broadly harmonized statistical approaches, thereby pioneering the research towards internationally comparable house price indices.

In describing the development of a house price index that was introduced in May 2005 in the Netherlands, Jansen *et al.* (2008) gave an insight on how a monthly index, called Woningwaarde Index Kadaster (House Price Index Kadaster), was designed to detect changes in the price of the overall stock of owner-occupied homes. Fifty-five indices were calculated: one overall index, four regional indices, 12 provincial indices and 38 indices based on combinations of region/province and dwelling type.

Recognizing the need to develop a reliable database on the actual price trends in the real estate sector, the National Housing Bank of India constituted a technical advisory group to deliberate on all aspects of constructing a representative housing price index (HPI). Initially, a pilot study of Bangalore, Bhopal, Delhi, Kolkata and Mumbai was undertaken, taking into account the actual transaction prices of residential properties for 2001-05, with 2001 as the base year. This complex exercise, which factored in such challenges as localities, covered area, community facilities, individual layouts, data distortions caused by transactions costs, etc., led to the launch of National Housing Bank (NHB) RESIDEX in July 2007 (NHB, 2009).

In another development, analysis of the residential property market, according to Nhleko and Tlatsana (2009), formed part of the South African monthly Monetary Policy Committee (MPC) dossier. The MPC read important information from house price graphs, using it to help track household wealth and informed its views on the main expenditure components, and shaped the committee's views on the effect of changes in the monetary policy stance on asset prices.

In Malaysia, the Malaysia House Price Index was initiated in 1993 and officially launched in 1997. The objective was to establish a national price index that could be able to monitor the movement of house prices in Malaysia and assist the policymakers in formulating national economic policy with respect to housing and property development. This index represented the overall housing markets and disaggregated according to region and house type with individual indices for key markets and house type (Dzurlkarnain *et al*., 1996; Wan Zahari and Nasir, 2002; VPSD, 1997; Hussain *et al.*, 2012).

Jeni (2010) reported the bubble in residential property market which existed only when there was an excessive bank-lending and low-borrowing cost. This unsustainable property price increment and shortage of capital by the banking institutions were noted as reasons for positive non-performing loans in Malaysia. In order to prevent the asset bubbles, a continuous monitoring by the Central Bank of Malaysia (CBM) on the property price trends and the introduction of appropriate measurements, such as the introduction of *"My First Home Scheme"* on 8 March 2011 to curb the real estate speculation activities and to support, stabilize and sustain the future of Malaysia's Residential property market was initiated (Azhar, 2011).

Moreover, given the changing nature of financial intermediation within increasingly competitive banking systems and structural shifts in demographics, migration and building regulations, according to Davis *et al.* (2011), the modeling of house prices has become important in its own right. One important conclusion of Davis *et al.* (2011) was that more resources must be devoted to collecting and disseminating data on house prices and related variables such as loan to value ratios since accurate house price modeling requires such information.

Subsequently, he argued that an understanding of deviations from equilibrium prices in housing markets requires reliability and for international comparisons (Silver, 2012)

Consequently, Eurostat (2012) published a Macroeconomic Imbalance Procedure (MIP) scoreboard for the surveillance of macroeconomic imbalances. The scoreboard consisted of a set of ten indicators that included house price indices (HPIs) taken from the experimental HPI for which data were publicly available in the Eurostat HPI released.

3.0 Methodology for Computing RPPI

House price transactions, according to Silver (2012), are infrequent and apply to a highly heterogeneous item; hence, comparing the prices of like with like on a regular basis is highly problematic. More so, secondary source data are generally used for house price indices (HPIs), and their nature depends on the institutional arrangements in a country for selling, financing, taxing, and registering the sale of a residential property. This gives rise to the potential for

quite significant methodological and coverage differences in HPI measurement, (see, for example, Carless, 2011).

Recent research by Eurosat (2011) showed that the approaches adopted by Statistical Agencies to construct RPPIs varied among countries and were dictated in large part by the availability of data generated by the processes involved in buying and selling a property. Hence, the challenges of compiling constant-quality residential price indices can be summarized by the following three factors:

(i) Residential properties are notoriously heterogeneous. No two properties are identical.

(ii) Prices are often negotiated. The (asking) price of a property is not fixed and can change throughout the transaction process until the sales is finalized. This means that, a property's market value can only be known with certainty after it has been sold.

(iii) Property sales are infrequent**.** In many countries, less than ten percent of the housing stock changes hands every year - this means that, a given house is likely to have a confirmed value not more than every ten years.

The four types of econometric methods considered include the hedonic regression, the repeat sales, the central price tendency, and the sales-based methods.

3.1 The Hedonic Regression Method

The application of hedonic techniques for the quality adjustment of prices and for computing price indices has made a significant contribution to the methodological development of price indices in recent years and is rapidly becoming a preferred method for compiling quality residential property price indices. However, there is no uniformity in the practical application of hedonics or agreement on what is the best practice (Eurosat, 2011). In practice, there are two alternative methods of application of hedonics to residential property, namely: *the Time Dummy Variables Approach*- which has the benefit of simplicity but with a major drawback which involves raising the issue of "revisability" of the index because it must be updated each time the regression is run; and *the Predicted Prices or Hedonic Imputation Approach*- in which a separate regression must be performed for each time period and the index be constructed by applying the estimated implicit prices to the relevant set of characteristics relating to residential properties.

Application of hedonic method potentially suffered from lack of some important house price determining characteristics in this paper.

3.2 The Repeat-Sales Method

The repeat sales method observes the price development of a specific house over a period of time by reference to the selling price each time it is sold. The price development of a "representative" selection of houses during overlapping time periods can then be observed to obtain a measure of the general trend in residential property prices. Measuring the average price changes in repeat sales on the same properties ensure a like for like comparison. In its standard form, it requires no information on characteristics of the dwelling units other than the addresses of the properties that are traded and source data could often be available from administrative records. However, its applicability in this work suffered a setback given that a house must be sold at least twice in a repeat sales index, and as such new residential constructions must be excluded from such an index. There was no adequate data to satisfy this necessary condition, which, in practice, is also sufficient to rule out the application of repeat sales method in residential property price index construction.

3.3 Central Price Tendency Approach

This approach is among the least data intensive of all the methods currently available to statistical agencies. The basic mean or median methods only need the selling prices of the properties in a given location to build a price index. Since the presence of outliers could be mitigated when the median price of properties in the sample is used instead of the mean price, the median approach was applied. Thus, in constructing the Nigerian residential property price index (NRPPI), location information was utilized. In addition, it was usual to stratify by the type of dwelling unit; hence, we modified the basic median method such that information on the type of dwelling was also utilized. In order to improve the reliability of the indicator, geographical stratification which has the advantage of reducing the effects of period-to-period compositional shifts in the housing units that characterize the simple mean and median methods was also introduced into the analysis.

3.4 Sales-based Approach

This approach defines a number of strata (cells), allocates the price observations to the cells, and computes a sales-based RPPI by a suitable index formula. The strata were defined by house characteristics, like type and region; hence, the RPPI was a reasonably good measure of the trend in house prices in Nigeria. The procedure for the sales-based RPPI is as follows:

a) Select a time period (month, quarter, year) that is to serve as unit of measurement, dependent on user requirements and data availability.
b) Collect transaction prices during each period.
c) Ensure that such prices reflect the values of the underlying properties (ideally, on a free market). This could imply deleting all transaction prices that are deemed unrealistic because they are too low, too high, or in some way fraudulent. There is evidence that people under time pressure tend to sell their houses for prices which are not precisely mirroring their values.
d) Check the representativity of the set (also called sample) of prices. Does the set contain all the transaction prices of the entire country during the time unit chosen? Or only the transactions in some capital city? Or only the transactions via some kind of real estate agencies? Or only the transactions of some specific kind of properties?
e) Define strata (cells) dependent on user requirements and data availability. Users could for instance want to distinguish between house types, age classes, regions, square meters, number of rooms, etcetera. Ideally the classification should be chosen such that in each time period there are sufficient observations to fill all the cells. Alternatively, and less demanding, is the requirement that for any comparison of two time periods there is a sufficient number of non-empty cells that match.
f) Let the cells be denoted by $1, \ldots, K$. Let for each time period, t, and cell, k, the sample of properties for which prices are observed be denoted by S_k^t $(k = 1, \ldots, K)$. Let the size of the sample be denoted by $n(S_k^t)$. For some time periods and cells this size could be equal to zero.
g) For each cell an appropriate location measure for the period, *t*, distribution of prices should be chosen; that is, a measure that can serve as center of this distribution. This is called a mean. Usually this is the arithmetic mean

$$P_a^t(S_k^t) \equiv (1/n\,(S_k^t)) \sum_{h \in S_k^t} P_h^t\,, \qquad (1)$$

where P_h^t denotes the transaction price of property, *h*, in period, *t*. But one could also opt for the geometric mean. This mean is less prone to outliers and can easily be calculated by exponentiating the arithmetic mean of the logarithms of prices. The third option is to use the median.

h) Though the choice of location measure might differ over the cells, the same measure should be used through time.

i) For each cell the (aggregate) price change between periods, *t*, and, *s*, can be

presented as an index number or as percentage.

j) The overall price change between periods, t and s can be represented by a Laspeyre's and/or Paasche's index number. But to avoid one-sidedness, the Fisher's index number could be used[3].

3.5 Data Collection

Residential property in Nigeria encompasses the land areas and the development thereof, building or housing projects, either for individual or condominium ownership, and other similar nature. This study focused only on building or housing projects, but given the extensive coverage of building or housing projects in the country, it considers only the state capital of the most popular states in each of the six geo-political zones of Nigeria. A questionnaire was designed to capture the relevant characteristics of residential properties that can influence prices like the type of structure, region/location, age, land plots, built-up area, number of bedrooms, quality of finishing, availability of basic amenities, among others. The distribution of the questionnaire was carried out based on expert judgment and the data obtained from the Nigerian Federal Housing Authority, State Ministries of Land and Housing, as well as registered Property Managers, Estates Surveyors and Valuers among others. However, the data were constraint by information on most of the price determining characteristics required to construct the indices using econometric methods like hedonic regression and repeat sales. However, the data contained information on some of the characteristics like the type of structure and the region. The type of structures include self-contained apartment (SCA), detached bungalow (DB), semi-detached bungalow (SDB), block of flat (BF), detached duplex (DD), semi-detached duplex (SDD) and terrace duplex apartment (TDA). The whole database from the six geopolitical zones: North East (NE), North West (NW), North Central (NC), South East (SE), South West (SW), and South-South (SS), contained approximately 1,500 trades observed between 2010 and 2012 after a cleaning process of the data and removing outliers or trades with no price information.

[3] **Remark:** It is imperative to emphasize here that users are generally interested in short term developments; that is, in comparisons of prices between periods t and $t-1$.

3.6 Mathematical Formulation

After screening out the hedonic regression and the repeat sales approaches due to data constraints, the mathematical structure for constructing a measure of the change in the central tendency for each stratum, such as a mean or median price index, and the aggregate mix-adjusted RPPI can typically be calculated as weighted average indices for each stratum. Consider M different strata, the dynamic of a mix-adjusted index can be expressed mathematically as:

$$P^{0t} = \sum_{j=1}^{M} w_j^0 P_j^{0t} \quad (2)$$

where P_j^{0t} is the index for stratum *j* which compares the mean (median) price in the current or comparison period *t* with the mean (median) price in an earlier or base period 0, and w_j^0 denotes the weight of stratum *j*. The weights are value shares pertaining to the strata. They refer to the base period, which is usually a year (whereas the comparison periods may be months or quarters). For practical reasons, the weights are often kept fixed for several years; however, keeping weights fixed for a long time is generally not a good practice (Eurostat, 2010).

Assumption: The concept of price in some time period *t* for a homogeneous stratum or cell (zone) in this stratification scheme will be a unit value.

This assumption follows the fact that each sale of a residential property comes with its own quantity, which is equal to one; hence, the corresponding quantity for that cell will be the simple sum of the properties transacted in period *t*. This is described mathematically as follows:

Suppose that in period *t* there are Q_{jk}^t property sales of structure type j in zone k, with the selling price of property i in structure type *j* in zone k equal to x_{ij}^{tk} for $i = 1, \dots, Q_{jk}^t$. $(j = 1, \dots, M^{tk})$, and M^{tk} is the number of structure types in zone k at time t. Then, the average price P_j^{tk} for structure type j in zone k at time t, is given by

$$P_j^{tk} = \sum_{i=1}^{Q_{jk}^t} x_{ij}^{tk} / Q_{jk}^t \quad (3)$$

The Fisher index is defined as the geometric mean of the Laspeyre's and Paasche's indices. Mathematically, this is given as follows:

Let $P^t \equiv [P_1^t, \dots, P_j^t]$ and $Q^t \equiv [Q_1^t, \dots, Q_j^t]$ denote the period t vectors cell prices and quantities. Then, the Laspeyre's price index, P_L^{0t}, going from (the base) period 0 to (the comparison) period *t* could be modeled as:

$$P_L^{0t}(P^0, P^t, Q^0) \equiv \frac{\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{j=1}^{M^{0k}} P_j^{0k} Q_{jk}^0} \tag{4}$$

Equation (4) can be written in the form of (2) with cell price indices, $P_j^{0t} = P_j^t / P_j^0$ and value shares, $w_j^0 = P_j^0 Q_j^0 / \sum_{j=1}^{M} P_j^0 Q_j^0$. Whereas, the Paasche price index going from period 0 to t could be written as:

$$P_P^{0t}(P^0, P^t, Q^t) \equiv \frac{\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{j=1}^{M^{tk}} P_j^{0k} Q_{jk}^t} \tag{5}$$

Hence, the Fisher ideal price index for period *t* relative to period 0, P_F^{0t}, could then be computed as the geometric mean of (4) and (5):

$$P_{kF}^{0t}(P^0, P^t, Q^0, Q^t) \equiv \sqrt{\left(\frac{\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{j=1}^{M^{0k}} P_j^{0k} Q_{jk}^0}\right)\left(\frac{\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{j=1}^{M^{tk}} P_j^{0k} Q_{jk}^t}\right)} \tag{6}$$

The overall Fisher ideal price index is given by

$$P_{NF}^{0t}(P^0, P^t, Q^0, Q^t) \equiv \sqrt{\left(\frac{\sum_{k=1}^{6}\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{k=1}^{6}\sum_{j=1}^{M^{0k}} P_j^{0k} Q_{jk}^0}\right)\left(\frac{\sum_{k=1}^{6}\sum_{j=1}^{M^{tk}} P_j^{tk} Q_{jk}^t}{\sum_{k=1}^{6}\sum_{j=1}^{M^{tk}} P_j^{0k} Q_{jk}^t}\right)} \tag{7}$$

Suppose that in period *t* and zone k, there are Q_k^t property sales of all structure types with the selling price of property i in zone k equal to x_i^{tk} for $i = 1, \dots, Q_k^t$. Then, the median price P_k^{*t}, and total sales V_k^t, for all structure types in zone k and period t, are given by

$$P_k^{*t} = \text{Median}\{x_i^{tk}, i = 1,2, \dots, Q_k^t\} \tag{8}$$

and

$$V_k^t = \sum_{i=1}^{Q_k^t} x_i^{tk} \tag{9}$$

respectively. Then, by adopting the quality constant price concept, the implied quantity Q_k^{*t} of sales of all property types in zone k at time t is given as

$$Q_k^{*t} = \frac{V_k^t}{P_k^{*t}} \tag{10}$$

Let the period t share of sales of all property types in zone k, S_k^t, (where $k = 1, \ldots, 6$) be given by

$$S_k^t = \frac{V_k^t}{\sum_{r=1}^{6} V_r^t}. \tag{11}$$

The zonal Törnqvist-Theil index P_{kT}^t is given by

$$P_{kT}^t = \left\{\frac{P_k^{*t}}{P_k^{*0}}\right\}^{\left\{\frac{1}{2}[\, S_k^0 + S_k^t]\right\}}. \tag{12}$$

The share weighted average of the zonal indices forms an overall Törnqvist-Theil index for Nigeria P_{NT}^t, which is given by

$$P_{NT}^t = \exp\left\{\sum_{k=1}^{6} \left\{\frac{1}{2}[\, S_k^0 + S_k^t]\right\} log_e \left\{\frac{P_k^{*t}}{P_k^{*0}}\right\}\right\} \tag{13}$$

4.0 Empirical Investigation

Based on the survey sample data from the six geopolitical zones of Nigeria, the median prices of residential property sales were obtained. The constructions of the stratum price indices that are then aggregated to the overall national index of interest often use median prices in practice. Thus, in constructing a mixed-adjusted price index, we first defined the stratum. Thereafter, we calculate the median price for the residential properties transacted within the stratum for the period in question. Finally, the median prices for all stratums were weighted together into an aggregate price measure for the market under study, which represent each zones and the country as a whole.

The computational procedure used in this study is as follows:

Step 1: Define the stratum. In this work, the stratum is a geographical subdivision zone of the country such as the North-East (NE), North-West (NW), North-Central (NC), South-East (SE), South-West (SW), and South-South (SS).

Step 2: Calculate the median price for a stratum such as a zone for the relevant period (year). It is assumed that the median is the representative price of all sales in that stratum. However, the mean price could alternatively be used. Repeat this step for future periods.

Step 3: Estimate the "average" price of the residential houses sold for a given period by calculating a sales weighted median of the zone or stratum prices. Since it is desirable to have price multiplied by volume to equal expenditure in each period for each zone, using the median price in each zone as a constant quality price for each time period leads to the data on expenditures (V), prices (P) and implied quantities (Q) in each zone..

5.0 Results and Discussion

The geographical subdivision (zone) of the country was defined as k (Table 1), so that $k = 1$ denotes the North-East (NE), $k = 2$ denotes the North-West (NW), $k = 3$ denotes the North-Central (NC), $k = 4$ denotes the South-East (SE), $k = 5$ denotes the South-West (SW), and $k = 6$ denotes the South-South (SS). The median price estimates for each zone was obtained from period $t = 0$ representing year 2010 to period $t = 2$ representing year 2012. By adopting the quality constant price concept, the implied quantity Q_k^{*t} of sales of all property types in zone k at time t was also obtained. It was shown that at period $= 0,1,2$, Q_k^{*t} decreased significantly in $k = 1$ from 9.0 to 6.8 which may be attributed to increase in price movement; for $k = 2$, it increased significantly from 6.1 to 8.2, which may also be attributed to a decresed in price movement (in particular, this might be due to speculations with respect to the Lagos State housing law) and then decreased to 6.1; for $k = 3$, it decreased from 10.3 to 7.0 and later increased to 8.0; for $k = 4$, It decreased from 7.5 to 6.7 and then increased to 12.0; at $k = 5$, It decreased slightly from 8.8 to 8.6 and significantly to 5.9; and at $k = 6$, it decreased slightly from 10.8 to 10.1 and significantly to 6.9 (Table 1).

Also, since it is desirable to have price multiplied by volume to equal expenditure in each period for each zone, using the median price computed in Table 1 for each zone as a constant quality price for each time period leads to the aggregate (National) results for the median price P_k^{*t}, the total sales V_k^t, for all structure types in zone k and period t and the implied quantity Q_k^{*t} of sales of all property types in zone k at time t as shown in Table 2.

Table 1: Median Price Estimates for Constructing Residential Property Price Indices (Törnqvist-Theil Index)

		k	t=0	SCA	DB	SDB	BF	DD	SDD	TDA	P_k^{*0}	V_k^0	Q_k^{*0}
2010	NE	1	P_1^{*0}	78.0	30.0	32.0	42.0	110.0	48.0	40.0	42.0	380.0	9.0
	NW	2	P_2^{*0}	22.5	90.0	100.0	47.7	120.0	100.0	64.0	90.0	544.2	6.0
	NC	3	P_3^{*0}	120.0	399.0	300.0	1500.0	780.0	650.0	405.0	405.0	4154.0	10.3
	SE	4	P_4^{*0}	48.0	250.0	449.9	910.0	650.0	612.0	450.0	450.0	3369.9	7.5
	SW	5	P_5^{*0}	84.0	144.0	60.0	480.0	150.0	180.0	220.0	150.0	1318.0	8.8
	SS	6	P_6^{*0}	33.0	60.0	70.0	351.0	480.0	235.0	126.0	126.0	1355.0	10.8
			t=1								P_k^{*1}	V_k^1	Q_k^{*1}
2011	NE	1	P_1^{*1}	33.3	100.0	84.0	180.0	120.0	108.0	50.0	100.0	675.3	6.8
	NW	2	P_2^{*1}	6.0	115.5	84.0	54.0	177.6	70.0	67.0	70.0	574.1	8.2
	NC	3	P_3^{*1}	80.0	920.0	875.0	350.0	1615.0	1608.0	990.0	920.0	6438.0	7.0
	SE	4	P_4^{*1}	135.0	459.0	210.0	560.0	715.0	416.0	300.0	416.0	2795.0	6.7
	SW	5	P_5^{*1}	28.0	200.0	240.0	350.0	525.0	585.0	130.0	240.0	2058.0	8.6
	SS	6	P_6^{*1}	35.0	30.0	130.0	252.0	585.0	192.0	90.0	130.0	1314.0	10.1
			t=2								P_k^{*2}	V_k^2	Q_k^{*2}
2012	NE	1	P_1^{*2}	65.0	132.5	103.6	133.5	150.0	68.0	55.0	103.6	707.6	6.8
	NW	2	P_2^{*2}	12.4	120.0	90.0	100.0	135.0	114.0	35.0	100.0	606.4	6.1
	NC	3	P_3^{*2}	110.0	390.0	874.0	510.0	1330.0	840.0	580.0	580.0	4634.0	8.0
	SE	4	P_4^{*2}	81.4	216.0	220.0	792.0	704.0	424.0	204.0	220.0	2641.4	12.0
	SW	5	P_5^{*2}	30.0	125.0	44.0	360.0	560.0	296.0	335.0	296.0	1750.0	5.9
	SS	6	P_6^{*2}	100.8	340.0	135.0	329.0	420.0	250.0	141.0	250.0	1715.8	6.9

Source: *Authors' Computation*

The result of the zonal residential price indices shows that residential house prices increased significantly in 2012 and in all the states chosen as zonal representative except in Enugu (SE) (Figure 1). This may be due to migration due to conflicts or crisis from and/or to a particular zone, government policies, etc.

Fig.1: Residential Property Price Index (2010=100)

Table 2: Zonal Expenditures, Prices and Implicit Quantities Using Median Prices as the Zonal Prices

Variables	2010	2011	2012
V_1^t	974.1	675.3	707.6
V_2^t	834.1	574.1	540.4
V_3^t	6464.0	6438.0	4634.0
V_4^t	3454.7	2795.0	2641.4
V_5^t	2636.9	2058.0	1750.0
V_6^t	2358.8	1314.0	1715.8
P_1^{*t}	42.0	100.0	103.6
P_2^{*t}	90.0	70.0	100.0
P_3^{*t}	405.0	920.0	580.0
P_4^{*t}	450.0	416.0	220.0
P_5^{*t}	150.0	240.0	296.0
P_6^{*t}	126.0	130.0	250.0
Q_1^{*t}	23.2	6.8	6.8
Q_2^{*t}	9.3	8.2	5.4
Q_3^{*t}	16.0	7.0	8.0
Q_4^{*t}	7.7	6.7	12.0
Q_5^{*t}	17.6	8.6	5.9
Q_6^{*t}	18.7	10.1	6.9

Source: *Authors' Computation*

After aggregating up the zonal price movements into an overall house price inflation rate, the Fisher ideal index was estimated as 1.2162 and 1.3360 in 2011 and 2012, respectively, while the Törnqvist-Theil ideal index PT, was estimated as 1.5586 in 2011 and 1.2771 in 2012, respectively (Figure 2).

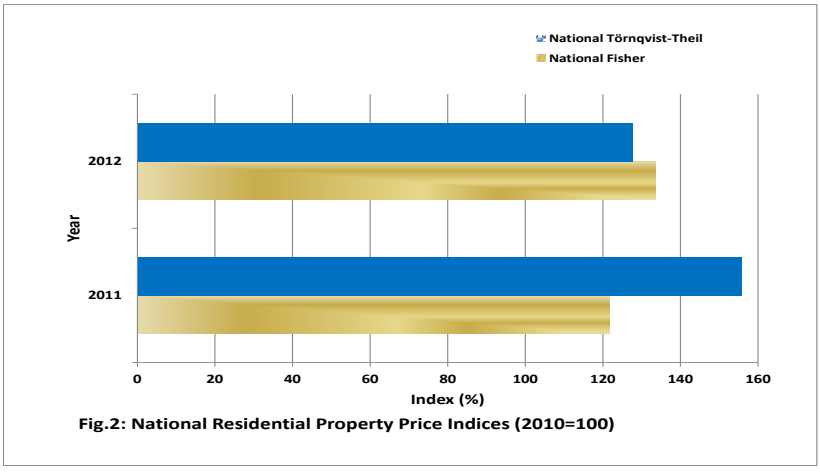

Fig.2: National Residential Property Price Indices (2010=100)

5.1 Implications of the Development

The sharp increases in house prices have spurred the concern of both government and other stakeholders as to their causes, their implications, and the prospects for the future. Thus, understanding the pattern and nature of residential property price dynamics could be seen as an important element in assessing the macroeconomic situation and outlook of any country, especially as the bursting of housing bubbles in a number of euro area countries and the United States has been a key contributing factor to the recent global financial crisis.

In particular, residential property price monitoring will provide a consistent measure of price movements over time and facilitate monitoring of its key determinants. In Nigeria, it will impact significantly on stock holdings in the National Accounts compilation, construction of consumer price index, measuring of Nigerian macro-economic growth. It may also influence Central Bank of Nigeria macro prudential regulation policy for financial stability or soundness, individual citizen's decision making on whether to buy (or sell) a residential property, wage bargaining and indexation purposes, as well as acting as a guide in making inter-area and international property price comparisons.

From the above expedition, it is evident therefore, that developing residential property price indices for Nigeria is of utmost important for many institutions, especially the Central Bank of Nigeria which have the statutory regulatory policy for financial stability and soundness, as well as other stakeholders in the economy.

6.0 Concluding Remarks

The development of residential property price indices constitutes an elaborate process both from a practical and from an analytical perspective. Consequently, it is very unlikely that different price indices will record the same numerical results (Figure 2), particularly in the case were the methodologies and/or the database used differ, even though one should expect that these follow the same trend. Nevertheless, the availability of a range of alternative residential property price indices is of importance given that no price index alone can encompass all possible advantages or exclude all possible disadvantages.

Although Comparing the available indices is complicated, some conclusions can be drawn from an analysis of the methods and data sets used. Hence, the NRPPI for year 2011 and 2012 with 2010 base year stands at 1.22 and 1.34, respectively (Fisher's), as well as 1.56 and 1.28, respectively (Törnqvist-Theil). These give estimates of the residential property price volatility of 22% in 2011 and 34 % in 2012 by using Fisher Ideal Price Index or 56% in 2011 and 28% in 2012 by using Törnqvist-Theil Ideal Price Index. This implies that residential property price index is a key example of an ancillary statistic (or indicator), that could often be consulted when analyzing the state of the economy generally, and inflation in particular. That is to say, it is a macroeconomic indicator which is viewed by some as being just as important for tracking the economy as, for example, GDP or estimates of industrial production, and in consequence, deserves its own place among other indicators. It could be an indirect contributor to the CPI, depending on the national statistical institute's choice about the conceptual treatment of owner-occupier housing costs in the CPI, and could therefore have a determining role in the measured rate of inflation.

The need for further studies using other methods (where data is available) and investigating the determinants of the significant increase in residential house prices in Abuja, Lagos, Rivers, Bauchi and Kano, as well as the insignificant change in Enugu is emphasizedd. This is because a study to document the relationship between house prices and locations, age of structure, and other properties in a residential real estate can result from monitoring the price trend in different parts of the country and working with investors and financial institutions to invest within these areas. Thus, since financial institutions also need accurate appraisal of homes on which they make loans, the National Bureau of Statistics in collaboration with the Central Bank of Nigeria and all relevance agencies are also strongly advised to conduct a housing survey that will have a complete attributes of price determinants for evaluation of the property, independent of the potential sale price, which is worthwhile and valuable. Such efforts will also improve the efficiency of mortgage process and consumer price index.

References

Alterman, W., W.E. Diewert and R.C. Feenstra (1999): International Trade Price Indexes and Seasonal Commodities, Department of Labor, Bureau of Labor Statistics, Washington, D.C.: U.S. Government Printing Office.

Australian Bureau of Statistics (2006): House Price Indexes, Eight Capital Cities. Cat. No. 6416.0.

Azhar, K. (2011): My First Home Scheme . An article published by *The Edge Financial Daily*, pp. 1-4 on June 3, 2011. [On line] http://www.theedgeproperty.com/news-a-views/6792-a-boon-for-smaller-developers.html.

Baldwin, A., Nakamura, A. and Prud'homme, M. (2010): An Empirical Analysis of the Different Concepts for Owned Accommodation in the Canadian CPI: The Case of Ottawa, 1996-2005. Paper presented at the Meeting of Groups of Experts on Consumer Price Indices organized by the UNECE and the ILO, Geneva, May 10-12.

Barrell, R., Davis, P., Karim, D., Liadze, I., (2010a). "Bank Regulation, Property Prices and Early Warning Systems for Banking Crises in OECD Countries". Journal of Banking and Finance, 34: 2255–2264.

Bostic, R., Stuart G., and Gary P. (2009): Housing Wealth, Financial Wealth, and Consumption: New Evidence from Micro Data, *Regional Science and Urban Economics*, 39: 79-89.

Campbell, J. Y., and Cocco, J.F. (2007): How do house prices affect consumption? Evidence from Micro Data. *Journal of Monetary Economics*, 54: 591-621.

Carare, A. and Stone, M. R. (2003): Inflation Targeting Regimes, IMF Working Paper WP 03/9.

Carless, E. (2011), "Reviewing House Price Indexes in the UK." Paper presented at the Workshop on House Price Indexes, Statistics Netherlands, The Hague, 10-11 February 2011.

Congressional Budget Office (2007): Housing Wealth and Consumer Spending, Background paper, January. Available at http://www.cbo.gov.

Davis, E.P. , Fic, T.M. and Karim, D. (2011): Housing Market Dynamics and Macroprudential Tools. Working Paper No. 11-07.

Davis, M.A. and M.G. Palumbo (2008): The Price of Residential Land in Large US Cities. *Journal of Urban Economics* 63, 352-384.

Diewert, W.E. (2009a): Durables and Owner Occupied Housing in a Consumer Price Index, pp. 445-500. In: *Price Index Concepts and Measurement*, W.E. Diewert, J. Greenlees and C. Hulten (eds.), Studies in Income and Wealth, Volume 70, Chicago: The University of Chicago Press.

Diewert, W.E. (2009b): The Paris OECD-IMF Workshop on Real Estate Price Indexes: Conclusions and Future Directions, pp. 87-116. In: *Price and Productivity Measurement: Volume 1—Housing*, Trafford Press and www.indexmeasures.com.

Dzurlkarnain, D., Thiruselvam, A. and Ibrahim, S. (1996): Development of Mass Appraisal Valuation Model using Multiple Regression Technique in Rating Valuation. Johor Bahru.

Eurostat (2010): Technical Manual on Owner-Occupied Housing for Harmonised Index of Consumer Prices, Draft, February 2010.

Eurostat, (2012): European Commission, Directorate G: Business Statistics, Unit G-6: Price statistics; Purchasing Power Parities, "Experimental house price indices in the Euro area and the European Union in the third quarter of 2011, 24 January, 2012, http://epp.eurostat.ec.europa.eu.

Finocchiaro, D. and V. Queijo von H. (2007): Do Central Banks React to House Prices? Working Paper Series 217, Sveriges Riksbank (Central Bank of Sweden).

Gelfand, A.E., M.D. Ecker, J.R. Knight and C.F. Sirmans (2004): The Dynamics of Location in Home Price. *Journal of Real Estate Finance and Economics* 29(2): 149-166.

Gudnason, R. and G.R. Jónsdóttir (2009): Owner Occupied Housing in the Icelandic CPI, pp. 85-88. In: *Price and Productivity Measurement, Volume 1: Housing*, W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), Trafford Press and www.indexmeasures.com.

Hussain, M. Y, Rahman, R. A, Husain, F. N. M., Lyndon N. and Ibrahin, N. N. (2012): Housing Bubbles Assessment 2005-2010 : Experiences in Klang Valley, Malaysia. Advances in Natural and Applied Sciences, 6(1): 33-41.

IMF (2006), *Compilation Guide on Financial Soundness Indicators*, Washington DC: IMF.

IMF (2009): The Financial Crisis and Information Gaps: Report to the G-20 Finance Ministers and Central Bank Governors. http://www.imf.org/external/np/g20/pdf/102909.pdf.

Jansen, S. J. T., de Vries, P., Coolen, H. C. C. H., Lamain, C. J. M., and Boelhouwer, P. J. (2008): Developing a House Price Index for The Netherlands: A Practical Application of Weighted Repeat Sales. Journal of Real Estate Finance and Economics, 37:163–186.

Jeni (2010): Property Bubbles- in Malaysia? An article published in *Estate 123: Commersial*. [on line] http://www.estate123.com/reviews_articles/article_review_detail.aspx ?a_id=557.

Kaminsky, G.L. and Reinhart, C.M. (1999): The Twin Crises: The Causes of Banking and Balance-of-Payments Problems, Vol. 89, No. 3: http://www.econ.uchile.cl.

National Housing Bank (NHB) (2009): Prices and Monetary Management. http://indiabudget.nic.in.

Nhleko, Z. and Tlatsana, G. (2009): A South African Perspective on the use of House Price Indices for Monetary Policy Purposes. Eurostat-IAOS-

IFC Conference on Residential Property Price Indices held in Basel, Switzerland from 11 to 12.

Reinhart, C.M. and Rogoff, K.S. (2008): The Aftermath of Financial Crises. http://www.economics.harvard.edu/files/faculty/51_Aftermath.pdf.

Silver, M. (2012): Why House Price Indexes Differ: Measurement and Analysis. IMF Working Paper, May 2012.

Velpuri, M. and Pinna, F. (2012): Real Estate Indices as a Barometer of Stable Real Estate Returns and Predictor of Real Estate Risks during Real Estate Boom or Burst Cycles. FIG Working Paper, Rome, Italy, 6-10 May 2012.

VPSD (1997): Malaysia House Price Index. Kuala Lumpur, Valuation and Property Services Department.

Wan Zahari, W.Y. and Nasir, M.D. (2002): House Price Dynamics: Evidence from a Malaysia Case Study. *International Real Estate Research Symposium*. Kuala Lumpur: 297-310.