HOUSING PRICE INDEX

CONCEPTUAL FRAMEWORK©

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KENYA BANKERS ASSOCIATION

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About this Framework

This framework forms the basis upon which the Kenya Bankers Association Housing Price Index (KBA - HPI) is computed. The framework provides an elaborate presentation of the model underlying the computation of the index and provides justification for the choice of the model. The KBA - HPI will be computed and published on a quarterly basis.

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Introduction

A housing price index (HPI) is a statistical device that measures changes in prices of residential houses. A HPI can be computed and published on a regular basis, often on a quarter, semi-annual or annual basis. The index can be measured by averaging the price changes in the house purchase prices including mortgage financing and refinancing appraisals.

A HPI is an important statistic. It draws its importance from the fact that in any economy residential property account for a significant portion of household wealth. Further, residential housing assets provide the collateral support for the mortgage market. It is noteworthy that the movement in the prices of residential houses is one of the leading indicators that support the outlook of the state of the economy at least in the near term.

The one attribute of the housing market that makes the case for the development of a credible and reliable HPI is that it is susceptible to boom and bust cycles. The index is therefore a tool that helps in the management of the risks associated with the unpredictability of the boom-bust cycles; indeed such unpredictability translates to volatility in the household wealth. Therefore as a tool that will support risk management, the HPI will enable the mark-to-market of the residential mortgages held by banks, pension funds, insurance companies and individual investors.

It is for the preceding considerations that the Kenya Bankers Association is developing a HPI to be known as the Kenya Bankers Association Housing Price Index (KBA-HPI). The KBI-HPI is underpinned by the centrality of the issue of credibility and reliability of the index. In developing the index, there is cognisance that:

(a) Returns on investment in real estate generally and housing in particular has to be compared with those in other segments such as bonds and stocks. The KBI-HPI will enable such comparison with the bond and stocks market indices;

(b) Investments in housing are becoming increasingly sophisticated as the financial sector modernizes. Such sophistication entails usage of modern financial analysis tools and investment vehicles such as securitization;

(c) There is continuous search for improved cost efficiency that in instances require automated appraisal technologies and reliance on capital-at-risk models. To the extent that such requirements hinge on accurate measures of risk and return by asset class, a housing price index produced on a high frequency (e.g. quarterly) will back such endeavor.

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The Model

Convectional housing price indices are based on models that assume that the changes in the indices from one period to another are wholly accounted for by pure price movement. That is however limiting at the very least, otherwise unrealistic, an assumption given that the quality characteristics of a house are core in determining the price.

Since the change in the housing price index may be partly due to price movement and partly due to changes in the quality of the house in the market, there is need to base the KBA-HPI on a model that generates a quality adjusted index. In order to take on board the heterogeneity aspect arising from the fact houses are of varied quality, size and other parameters, the KBA-HPI utilises a hedonic function so as to address the observed limitations associated with conventional indices.

From literature, the main alternative elementary models for computing dwelling price indexes in the hedonic framework are the ratio of (un-weighted) arithmetic means of prices (the **Dutot price index**) and the ratio of (un-weighted) geometric means of prices (the **Jevons price index**). The Dutot and Jevons price indices for period s can be explained as follows:

Dutot price index is given by:

$$\overline{I_s^D} = \frac{1/N_S \sum_{i=1}^{N_S} p_{is}}{1/N_0 \sum_{i=1}^{N_0} P_{i0}}$$

Jevons price index is given by:

$$\overline{I_s^J} = \frac{\exp\left[1/N_S \sum_{i=1}^{N_S} \ln p_{is}\right]}{\exp\left[1/N_0 \sum_{i=1}^{N_0} \ln P_{i0}\right]}$$

The two price indices measure the overall dwelling price change between period 0 and period s. That change may be due to the different characteristics of the dwellings sold in each period or may be the result of a pure price movement. Assuming that the characteristic of each dwelling is evaluated and that dwellings are interpreted as aggregations of characteristics, both Dutot and Jevons indexes may be decomposed into two components:

(a) A quality index (I_s^{Dq} or I_s^{Jq}), which assumes that the implicit prices of the dwelling characteristics did not change over time and, therefore measures the price change that is explained by changes in the dwelling characteristics;

(b) A quality-adjusted price index (I_s^{DP} or I_s^{Jq}), which assumes that the characteristics of the dwellings are constant across time and measures the price change that is due to changes in the prices of the dwelling characteristics.

Thus, we may express the population Dutot price index as:

$$I_s^D = I_s^{DP} . I_s^{Jq}$$

Similarly population Jevon price index can be expressed as:

$$I_s^J = I_s^{JP} . I_s^{Jq}$$

Where

$$I_S^{Dq} = E\left(P_b / x_{ia}\right) \Big/ E\left(P_b / x_{i0}\right) \quad \text{and} \quad I_S^{DP} = E\left(P_S / X_{ia}\right) \Big/ E\left(P_0 / X_{ia}\right)$$

$$I_S^{Jq} = \exp\left[E \ln\left(P_b / x_{is}\right)\right] \Big/ \exp\left[E \ln\left(P_b / x_{i0}\right)\right] \quad \text{and} \quad I_S^{Jp} = \exp\left[E \ln\left(P_b / x_{ia}\right)\right] \Big/ \exp\left[E \ln\left(P_b / xa\right)\right]$$

We note that when (a, b) = (0, 1) then I_s^{DP} and I_s^{JP} are Laspeyres-type quality adjusted prices indexes since the comparison is based on the houses existing at the base period.

On the other hand, if (a, b) = (1, 0) then I_s^{DP} and I_s^{JP} become Paasche-type quality adjusted housing price indexes since the comparison is based on the current period.

Hedonic methods are based on the idea that certain product characteristics provide pleasure to the buyer and therefore it is necessary to determine the prices of those characteristics (attributes), the so-called implicit prices. After estimating implicit prices, the hedonic product price is derived as the sum of implicit prices of individual product characteristics.

In the context of the real estate market, the goal is to express the benefits that the buyer derives from, for example, the floor area of a housing unit, balcony or a certain location in a given city. Further, by comparing implicit prices of characteristic we can investigate buyer preferences more closely. We can, for example, obtain answers to the following questions: how important is it to the buyer that the dwelling is situated in a particular part of the city? Or does the buyer care about the type of the dwelling – e.g. a block or condominium, a stand-alone house, etc.?

The problem is how to formalise this intuitive idea, in particular how to describe the relationship between the price of certain real properties and accompanying characteristics in a function. While the advantages of the hedonic modelling over the traditional methods of price index calculation, the shortcomings of hedonic methods are their relative technical complexity, require much more careful

interpretation ability and require a database that extends beyond to prices includes the other characteristics of real estate, which database may not be common.

The KBA-HPI is computed on a database that has been constructed to address the limitations of the hedonic model. Bothe the price and the qualitative attributes of each house on the houses in the database. Like all indices, the dataset of based on a sample, not the population. Data representing over 80 percent of the mortgage portfolio of banks, data from the National Housing Corporation is utilised.

It is acknowledged that other market players in residential house market such as savings and credit cooperative organisations (SACCOs) are increasingly playing a role on the supply side; it is worth nothing that a large portion of the house whose construction they support are not for the market but for the occupancy of the benefiting members.

In settling for the hedonic model, we have taken cognisance that under certain circumstances it could be rivalled by another methodology called Repeat Sales Model. The Repeat Sales Model is one where an index is constructed to track price changes for houses that are repeatedly put in the market. It has been argued that the repeat sales and hedonic methods could be equivalent if it is reasonable to assume that if the levels and attributes of the underlying houses remain the same over time.

The choice of the hedonic method over the repeat sales is informed by the number of limitations of the latter, which include the following.

- It is inefficient in the sense that it does not use all of the available selling prices; it uses only information on units that have sold more than once during the sample period.
- It utilizes information on 'identical' properties which have been sold more than once.
- It assumes that the characteristics parameters of different houses are fixed over time.
- The standard version of the method ignores (net) depreciation of the dwelling unit.
- There may be a sample selection bias problem in the method; the model is often criticized for being inefficient as, by design, it "throws away a lot of data".
- It cannot provide separate price indices or land and for structures.
- It cannot be used if indexes are required for very fine classifications of the type of property sold. In particular, if monthly property price indexes are required, the method may fail due to a lack of market sales for smaller categories of property.
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- It cannot be used if indices are required for very fine classifications of the type of property sold. In particular, if monthly property price indexes are required, the method may fail due to a lack of market sales for smaller categories of property.
- In principle, estimates for past price change obtained by the method should be updated as new transaction information becomes available. Thus it could be subject to never ending revision.

We develop the hedonic pricing models for the housing sector as follows:

$$\ln p_{it} = \alpha + \beta \ln m_i + \sum_{j=2}^{T} \delta_j D_{ij} + \sum_{j=1}^{L} \gamma_j x_{ij} + \varepsilon_{it}; i = 1.....N$$

x_{ij} are the qualitative characteristics of the houses, m is the total surface area covered by the house, a and β are real constants, D_j, $j = 1... T$ are time dummy variables where $Dij = 1$ if the ith real estate has been financed during the period j, and $Dij = 0$ u in other cases. Further, δj and are regression coefficients, and εi random error.

It is evident from the hedonic pricing model above that we want to express the (logarithm) price of real estate as the sum of implicit

prices of its (logarithm) floor area and the group of characteristics, where we allow the price to be influenced also by the period in which the transaction was carried out. We assumed that implicit prices of characteristics do not change over time (using fixed coefficients for the same characteristics in the whole sample), but that the changes in prices are fully reflected by coefficients δj next to time dummy variables. These coefficients are treated as pure prices of real estate in the sense that they are not affected by the fact that individual real properties might be better or worse located, have more or fewer rooms, etc. They reflect only the fact that the real estate has been sold during a given period.

After estimating the parameters in hedonic pricing model, the price of real property with the random characteristics vector (m, X) in period t is approximated as follows:

$$\hat{P}_t = e^{\left(\alpha + \sigma \ln m + \delta_t + \sum_{j=1}^{1} y_j x_j\right)}$$

where x_{ij} comprises the house characteristics illustrated below :

Upon getting the exponential of the time dummy coefficient we deduct the 100 per cent since the prices for the base year are assumed to be 100 for us to obtain the price change for that period.

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