

## **REAL ESTATE PRICE INDICES CALCULATION METHODS: METHODOLOGICAL REVIEW**

**Wickramaarachchi N.C<sup>1</sup>, Thilini.K.A.M<sup>2</sup>, Anuradha.P.A.N.S<sup>3</sup>**

<sup>1,2</sup>Department of Estate Management and Valuation, University of Sri Jayewardenepura,  
Sri Lanka  
malkathilini@gmail.com  
nishani@sjp.ac.lk

<sup>3</sup>Department of Finance, University of Sri Jayewardenepura, Sri Lanka,  
anuradha@sjp.ac.lk

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### **ABSTRACT.**

Sri Lankan Real Estate market is experiencing a boom after the post war period. In the present context investments in real estate markets have been increased by both local and international investors where international investors play a significant role. Even though there are more investment opportunities in the Sri Lankan Real Estate market, the absence of a proper mechanism to identify the price trends in real estate properties have become a vital issue which bothers investors in the decision-making process. Filling this research gap in Sri Lankan context is of vital importance not only to the potential investors and policy makers in the Real Estate market but also to professionals in other businesses who will be benefited equally while serving their information thirst. The data collection was purely literature based. Among the available sources, there are different types of indices available worldwide. Among them, real estate price indexes were selected for further analysis purposes. Many methods have been applied to calculate the real estate price index, yet no review has done to identify which method is most suitable for Sri Lanka. This paper aims to present a critical review of the real estate price index calculation methods and techniques already applied. Real estate price index calculation methods were used as data of this study and it was collected through 35 Google scholar indexed Journal articles during 2000-2020. Critical review method and descriptive review method were used to analyze the data according to the chronological order. As per the analysis of the literature, there are 6 main methods to calculate the property price index such as, Simple Mean/ Median method, Stratification or mix adjustment method, Hedonic Regression method, Repeat sales method and Appraisal-Based methods. However, results emphasized many methods are quantitative as well as the Hedonic Regression method is the most commonly and widely used method. In addition, it is appropriate method to construct a property price index in Sri Lanka.

**Keywords:** Real Estate Price Index, Hedonic Regression Model, Repeat Sale model, Appraisal Methods

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### **1. INTRODUCTION**

Real Estate is one of the precious assets because of its significant feature, hedging against inflation and it is an asset class that attracts substantial attention from both institutional and individual investors. In gaining the utmost benefit of this feature real estate should be purchased or sold at the correct time at the correct value to maximize the financial returns. Frequently, price fluctuations make the decision process a complex one to the investors because of its unpredictability where the investor tends to make decisions on their own judgment which will result either in excess profits or hefty losses.

Moreover, real estate Investment managers include real estate into their portfolios to achieve diversification and superior risk-adjusted returns. Therefore, the demand for high quality and accurate real estate indices has emerged to reflect the performance of real estate and the state of the market.

As a developing country, the Sri Lankan Real Estate market is experiencing a boom after the post war period. In the present context investments in real estate markets have been increased by both local and international investors where international investors play a significant role. Even though there are more investment opportunities in the Sri Lankan Real Estate market, the absence of a proper mechanism to identify the price trends in real estate properties have become a vital issue which bothers investors in the decision-making process. Accordingly, this leads the investors to purchase unworthy properties at higher prices which affect the security of their investments adversely. Therefore, inability of taking clear decisions regarding when to buy or sell a Real Estate remains as another issue as well as some Real Estate developers earn abnormal profits from Real Estate dealings due the fact that buyers do not have a proper knowledge about price trends in the Real Estate market. Internationally, many methods have been applied to calculate the real estate price index, yet no review has been done to identify which method is most suitable for the Sri Lankan real estate sector. Hence, this paper aims to present a critical review of the real estate price index calculation methods and techniques already applied worldwide. Filling this research gap in Sri Lanka context is of vital importance not only to the potential investors and policy makers in the Real Estate market but also to professionals in other businesses who will be benefited equally while serving their information thirst.

Property price index is important in individual decision making, such as decision making on when to buy or sell a Real Estate property (Balk, Haan, &Diewert, 2013; Eurostat; International Labor Organization; International Monetary Fund; Organization for Economic, 2013). For almost all the countries, investment on Real Estate is a vital aspect to the economic development and property price index plays a significant role for that.

## **2. LITERATURE REVIEW**

As per the analysis of real estate indices in other countries, higher frequency indices (quarterly and monthly) generally provide more up-to-date information, but often with more noise, than low frequency indices (annual). Recently, the construction of higher-frequency indices has gained particular attention. Bokhari and Geltner (2012) argue that there is an increased demand for reliable higher-frequency indices from the derivatives trading sector. Moreover, higher-frequency indices provide greater opportunity to perform a sophisticated econometric analysis of the real estate market due to the large sample size. This is particularly important for emerging markets (Fuerst, Liu , & Lizieri , 2015).

## **3. METHODOLOGY**

The data collection was purely literature based. Real estate price index calculation methods were used as data. Data was collected through 35 Google scholar indexed Journal articles during 2000-2020. Critical review method and descriptive review method were used to analyze the data according to the chronological order.

## **4. DATA ANALYSIS**

### **4.1 Real Estate Price Index Calculating Methods**

- Simple Mean /Median Method

The simplest methods of constructing a Property Price Index based on some measures of central tendency from the property prices sold in a period especially use mean or the median. In this method the median is mostly used rather than mean without considering the characteristics of properties and price index calculate changes in price of the median properties sold from one period to next period. Ignoring different type properties are sold each period such as two bed room, three bed rooms, houses with swimming pool and dwellings etc.(CBSL) There are some advantages when using Mean or Median method such as easiness of understanding. (Eurostat; International Labor Organization; International Monetary Fund; Organization for Economic, 2013).

- Stratification or mix Adjusted Method

Stratification method used to reduce sample bias. When compiling Property Price Index, stratification is the simple tool for controlling differences in the composition or “quality mix” of the properties sold, and this method is used when users desire price indices for different property market segments. Stratification is nothing else than straightening out the total sample of properties into a number of sub-sample or strata. Then measure of the change in the central tendency for each stratum is derived, such as mean or median price index. Aggregate mix-adjusted Property Price Index is usually calculated as a weighted average of indices for each layer (Eurostat; International Labor Organization; International Monetary Fund; Organization for Economic, 2013).

- Hedonic Regression Methods

The hedonic regression method acknowledges that heterogeneous goods can be explained by their attributes or characteristics. That is, a good is basically a bundle of (performance) characteristics. In the housing context, this bundle may include attributes of both the structure and the location of the properties. There is no market for characteristics, since they cannot be sold independently, so the prices of the characteristics are not independently observed. The demand and supply for the properties implicitly decide the characteristics’ marginal contributions to the prices of the properties. Regression techniques can be used to assess those marginal contributions or shadow prices. One purpose of the hedonic method might be to get estimates of the willingness to pay for, or marginal cost of producing, the different characteristic. (Haan & Diewert, “Hedonic Regression Methods”, 2013)

- Time Dummy Variable Method

Time Dummy Index as One of the Sub-types of Hedonic Real Estate Price Index. The time dummy variable approach to forming a hedonic house price index has been used repeatedly in academic studies but not so much by statistical agencies. (Diewer, Heravi, & Silver, 2009); (Haan, Hedonic Price Indexes: A Comparison of Imputation, Time Dummy and Other Approaches, 2010))

- Repeat Sales Methods

The repeat sales method is transaction-based price index. This method was firstly recommended by (Bailey, Muth, & Nourse, 1963). The essence of the repeat sales approach is to measure the same asset in two periods while assuming that the asset attributes do not change over time. Bailey, Muth and Nourse (1963).

Furthermore, the repeat sales approach only consist of properties that have been transacted more than once which may result in inefficient use of the data and sample selection bias as the sample has been chosen in a non-random way (Cheung, Yau, & Hui, The effects of attributes on the repeat sales pattern of residential property in Hong Kong, 2004), (Gatzlaff & Haurin, 1997) show that the degree of sample-selection bias depends on the change of

economic conditions. Another assumption of repeat sales indices is that transactions are assumed to be the accurate measurement of market prices. (Bourassa, Cantoni, & Hoesli, 2013) argue that forced sales will distort the repeat sales indices and may not indicate the true market prices. Heteroscedasticity is also frequently encountered in repeat sales models possibly due to the larger variation of prices and attributes in the upper market segments but Case and Shiller (1987) present a weighted repeat-sales model (WRS) to overcome this problem.

- **Hybrid approach**

Case and Quigley (1991) introduce a hybrid method that combines both the repeat sales and the hedonic pricing approaches. It removes the assumption of the repeat sales approach by allowing the hedonic attributes to be varied across time. The hybrid approach is expected to be more efficient than both repeat sales and hedonic approaches. However, the availability of repeat sales data has continued to be a challenge, especially in the office market where transactions are infrequent. The hybrid approach also needs information on all appropriate hedonic attributes which may be hard to get. This approach is data intensive because of the functional form assumption and omitted variable bias (Chau K. , Wong, Yiu, & Leung, 2005). It suffers from the same problems encountered in both approaches such as forced sales and immediate second sales and potential misspecification of the hedonic equation.

- **Appraisal Method**

The Appraisal-Base Methods has been used in New Zealand and several European countries, such as Denmark, Netherland and Sweden. In most of countries information of assessed values or valuations of properties are available, which may be useful as substitutes for selling prices or, market value of the property. The use of a conventional matched model index number formula simplifies the calculation of the index because there is no need to use econometric methods to estimate the index or to adjust for compositional change, as is the case with hedonic and repeat sales methods. The sale price appraisal ratio method (SPAR) is free from revisions because there is no modeling and pooling of data involved. In comparison to the repeat sales methods and the multi period time dummy hedonic method, previously computed price indices are not re-estimated when new sales data are available. (Eurostat; International Labor Organization; International Monetary Fund; Organization for Economic, 2013)

#### **4. RESULTS AND DISCUSSION**

There are two major approaches to controlling for quality: valuation-based and transaction-based methods. The method employed is often dictated by data availability. the hedonic pricing model, the repeat sales model, and the hybrid model. These are collectively known as transaction-based models. The literature analysis showed that, there are 6 main methods of constructing a property price index such as Simple Mean/ Median method, Stratification or mix adjustment method, Hedonic Regression method; Repeat sales method, Hybrid approach and Appraisal-Based Methods. Simple mean /median method is the simplest method. In this method, the median is mostly used rather than mean without considering the characteristics. When compiling Property Price Index, stratification is the simple tool for controlling differences in the composition or “quality mix” of the properties sold, and this method is used when users desire price indices for different housing market segments. Further, Stratification can be interpreted as a special case of regression. It can be discussed more as a general technique, known as hedonic regression when applied to price index construction and quality adjustment. The hedonic regression method acknowledges that, heterogeneous goods can be explained by their attributes or characteristics. But multi collinearity is a well-known problem in hedonic regressions. Repeat sales method ignores the property characteristics. This

assumption has been criticized by many researchers and this method application in Sri Lanka is just difficult until computerized the Land registry details. At present it is updating and in near future this method also can be applied.

The hybrid model is more efficient than the hedonic pricing model but is still subject to the charge of the functional form assumption and the omitted variable bias. Most of the existing real estate index literature focuses on analyzing capital values, repeat sales approach presents more bias and inefficiency problems than the hedonic pricing approach, a hybrid method by comparison, is a superior approach as it avoids most of the bias and inefficiency through the combination of hedonic pricing and repeat sales. The Appraisal-Base Methods has been used in New Zealand and several European countries, such as Denmark, Netherland and Sweden, when comparing Sri Lankan property market, this method is difficult to apply. This method uses much more data than the repeat sales method and hence there are fewer problems due to sparse data and the SPAR method does not suffer from revision of previously calculated figures when new data becomes available.

## 5. CONCLUSION

In this paper descriptively reviewed about 06 methods were used as data and reviewed chronologically. Results revealed that, simple mean/median method, repeat sale method and Hadronic regression methods are suitable to calculate real estate price index but in practically, repeat sale method application in Sri Lanka is just difficult until computerized the Land registry details. other techniques are downward biased because they failed to control for both quality changes and developer pricing behaviors compared to the hedonic approach as well as when compared the hedonic model and repeat sales indices of house prices and found that the hedonic indices appear to be more stable than the repeat sales index when adjusted for new information. At the end of the study, the Hedonic Regression method was identified as the most commonly and widely used method as well as it is appropriate method of constructing a property price index in Sri Lanka.

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