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An Application of House Sales Methodology on Turkish Real Estate

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Abstract:
The application of house sales methodology in Turkey was investigated where House Price Index (HPI) was used as the dependent variable against New House Price Index (NHPI), Hedonic House Price Index (HHPI), and Existing House Price Index (EHPI). The data used were sourced from the online publications of Turkey statistical bulletin (TUIK) from 2010M1 to 2018M12. Descriptive analysis and regression method were employed, and the study found that new house price index has a positive and significant effect on house price index in Turkey and when NHPI increases with one unit, the house price index will positively increase with the value of 0.416993. The coefficient value of hedonic house price index is 0.115156 with p-value of 0.0640 implying that HHPI has a positive effect but it is not significant at 5% level of significance. The coefficient value of existing house price index is 0.543676 and its p-value is 0.0000 showing that EHPI has a positive and significance effect on house price index in Turkey. It was concluded new house price index and existing house price index could contribute significantly to the house pricing in Turkey.

Keywords: Repeat sales, house price, existing house price, and real estate

1. Introduction

The application of house sales methodology in Turkey cannot be over-emphasized. This necessitates the previous researchers to measure its impact and the connection in different countries of the world. Its output has made the subject matter to be hotly debated in the literature. The real estate sector is playing an increasingly important role in most economies where Turkish economy is not left out, given the extent of its diffusion effects on other sectors and the implications of price real estate assets on inflation, monetary policy, banking supervision, and financial stability. The establishment of a property asset price monitoring system is hence of crucial importance, as a result of its potential contribution to improving the transparency and functioning of the real estate market, as well as to strengthen the monitoring of property prices of the sectorial situation. In addition, the availability of sub-annual real estate price data will help sharpen the monitoring and analysis frameworks for monetary policy, banking supervision, and financial stability. Repeat sales method is one of the unique methods among house price index construction practices which focus on data that directly measure the variable of interest of house price appreciation. However, the major key to these method is that there are observations of multiple transactions on the same property (Deng, McMillen & Sing, 2012). Literatures on real estate construction index have been built on hedonic and repeat sales methods. The main benefit of the repeat sales over the hedonic method is the specification error and features which does not observed in the data. (Francke & Minne, 2017).

The real estate indices are designed to measure the performance of direct investment (in equity) in real estate. The most natural way to calculate the performance of these indices would be to observe the price movements of the underlying assets in the markets and to weight their modifications according to a given weighting system. However, since real estate is not traded frequently, it is difficult to obtain enough transaction prices, or more particularly the evolution of these prices, to calculate classical indices. Transaction price is possible to work around this problem by using regular appraisals performed by real estate professionals, instead of transaction prices. These indices of expertise are particularly important for the commercial real estate market, given limited comparability of goods and reduced number of transactions in this market. However, even if the properties that make up the index are not all traded between two index calculation dates, it remains possible to determine the evolution of a transaction index. The real estate sector is very heterogeneous in nature, which makes it difficult to have a single price approach because the price formation of different goods is influenced by intrinsic characteristics (area, number of rooms, age, etc.) and geographical location of real estate. Similarly, changes in average prices may occur due to changes in the composition of dwellings sold from one period to another and thus result in a price evolution profile that does not reflect the actual conditions of supply and demand in the real estate market. By way of illustration, the transactions may concern mainly high-end apartments during a quarter and mainly involve economic apartments in the following quarter. To limit the effect of one or more of the above-mentioned constraints and depending on the nature and richness of the available databases, several approaches to developing real estate asset price

indices are adopted at the international level. After a discussion of the most used among these approaches, this paper presents a description of the data available at the national level and their treatment before focusing on the method chosen and the reasons for its use.

1.1. Objectives of the Study

The specific objectives are to:

- Examine the impact of hedonic house pricing index on house sales in Turkey;
- Investigate the impact of new house pricing index on house sales in Turkey;
- Determine the impact of existing house pricing on house sales in Turkey.

1.2. Scope of the Study

This study examines the application of repeat sales methodology on real estate in Turkey using secondary data that spans from 2010M1 to 20118M11. The monthly data were extracted and sourced from the statistical page of Turkish data. The study intends to carry out an up-to-date analysis which necessitates the use of 2018 data in order to produce objective conclusion and recommendations based on the findings of the study.

2. Literature Review

Name & Year	Nation	Subject	Outcome
Blight and MacFarlane (2002)	Sydney	Property price and valuation modelling in Sydney.	The study revealed that short term movements are more haphazard but are smoothed out over time
Thion, Riva, and Chameeva (2005)	France	Repeat sales and urban price indices using a new approach in France.	The results obtained both from a simulation process and a database sample for Bordeaux region in France.
Peng (2010)	Chicago	Repeat sales on heterogeneous property in Chicago Housing from 1970 to 1986	It was revealed that heterogeneity in property value appreciation across sub-markets, and replications display that the assessment is controlling in small samples
Boudry, Coulson, Kallberg and Liu (2012)	US	What commercial real estate price indices really measures	The study revealed that cumulative real estate indices make an unobtrusive showing of clarifying individual property cost appreciation.
Jiang, Philips and Yu (2015)	Singapore	A new methodology for constructing real estate price index using Singapore Residential Market.	It was found to perform much better in out-of-sample prediction exercises than either the S&P/Case-Shiller index or the index based on standard hedonic methods
Francke and Minne (2017)	Philadelphia	The hierarchical repeat sales model on marketable assets in the Philadelphia/Baltimore region and on residential properties in a small part of Amsterdam.	The results of the study showed that the hierarchical repeat sales model provides reliable indices.

Table 1: Review of the Previous Article
Source: Writer's compilation (2020)

Turkey's real estate market is gaining momentum, said Vera Houthoofd of Turkimmo, where the number of homes sold to foreigners rose 17.3 percent in the first quarter, compared to 2014's prices. This development mainly concerns buildings over 10 years old, with fewer facilities than new ones, while new construction has remained almost unchanged since last year, with new buildings favoring modern infrastructures. And new types of material. According to Veronique Matthys of Immo Turkuaz, it is difficult to give an overview of the prices practiced on the Turkish real estate market.

"There are huge differences between Istanbul, the tourist coasts and the eastern part of the country, and the Turks are not used to mention the sales price actually agreed on the title deed, the "official" figures are therefore unreliable".

	Turkey	Istanbul
2013	1,157,190	234,789
2014	1,165,454	225,454
2015	1,289,320	239,767
2016	1,341,453	232,428
2017	1,409,314	238,383

Table 2: Number of house sales (Total)
Source: Author's compilation (2019)

2.1. The Repeat Sales

The repeat-sales house price index appears in the United States. It is multiple indexes set to calculate housing prices. It is a monthly index starting from 1987 to this present time. The guides kept by Standard and Poor are normalized to have a value of 100 in January 2000. The weighted form is a modification of the regression proposed by Bailey. The BMN method produces estimates and standard errors for an index of housing prices by regressing (Case and Shiller, 1988). The repeat sale method deals with properties sold more than once. The information needed to estimate an equation using a repeat sale index deals with price, sales date and address of the properties. Unlike the hedonic model, fewer intensive data is required to evaluate the price of an estate.

With the continuous expansion of Turkish real estate market, the impact of real estate prices on social production and life is becoming more and more obvious. Accurate real estate price index is of great significance for improving the quality of government economic decision-making, reasonably guiding social expectations and public demand, and reducing the blindness of real estate development investment. The repetitive sales method solves the problem of ensuring the homogeneity of samples in the process of real estate index preparation and is an internationally popular index preparation method. The principal component analysis (PCA) index is a repeat sales index calculated from economic variables and financial variables. The construction process of the index includes four steps: determining the profit rate of the house, determining the profit rate of the economic and financial variables, establishing the factors, and constructing the index.

2.2. The Hedonic Price Model

The hedonic price method is commonly used in economics and statistics. Intuition simple is that the price of a good (apartment, car, computer etc.) or a service (salary) is a function of its features. For instance, the value of a home would be explained by its surface, its number of pieces but also by the infrastructures or the pollution present in his neighborhood. This method serves to calculate and correct indices price to non-market goods or environmental amenities. Hedonic methods are based on the idea that it is necessary to determine the prices of the characteristics (attributes) which appeal to the buyer. This latter can prefer to buy a housing unit with a balcony or chooses a flat in a location in a city. The price of the estate will be strongly related to the characteristics rather than to the estate itself.

3. Methodology

3.1. Source of Data

In order to achieve the broad objective of this study, secondary data were used and sourced from the online publications of Turkey statistical bulletin (TUIK). Monthly data were obtained from 2010 to 2018 for analytical purpose.

3.2. Estimation Techniques

The study used both descriptive and inferential statistics. The descriptive statistics involve the mean, median, maximum, minimum, Skewness, and Kurtosis while inferential statistics used was regression analysis and used diagnostic measures in the form of normality test, serial correlation and, Heteroscedasticity test.

3.3. Model

This study examined the application of house sales methodology on real estate using a single model. The multiple regression model was employed in the form of dependent and independent variables. The dependent variable used was house price index (HPI) while the independent variables are new house price index, hedonic house price index and existing house price index which were the method used in Turkey for house price extraction. The model is presented as:
HPI = ƒ(NHPI, HHPI, EHPI u) 4.1
Where
HPI = House Price Index
NHPI = New House Price Index
HHPI = Hedonic House Price Index
EHPI = Existing House Price Index
U = Others
The mathematical form of equation 4.1 is as follows:

HPI = $\theta_0 + \theta_1 NHPI + \theta_2 HHPI + \theta_3 EHPI$ 4.2
The econometric form is shown below
HPI = $\theta_0 + \theta_1 NHPI + \theta_2 HHPI + \theta_3 EHPI + \varepsilon$ 4.3
While the time series is presented as
$HPI_t = \theta_0 + \theta_1 NHPI_t + \theta_2 HHPI_t + \theta_3 EHPI_t + \varepsilon_t$ 4.4
Where
θ_0 = Constant
$\theta_1 - \theta_3$ = Shift parameter
t = time series

4. Result and Discussion of Findings

4.1. Descriptive Analysis

Descriptive analysis is used to measure the normality of the variable which comprises the mean, median, maximum, minimum, standard deviation, Skewness and Kurtosis.

	HPI	NHPI	HHPI	EHPI
Mean	170.1412	165.5990	153.1969	167.9898
Median	157.9200	156.1100	144.8900	155.3400
Maximum	275.5000	259.0300	227.6500	271.7000
Minimum	96.92000	96.62000	97.05000	97.79000
Std. Dev.	56.00404	50.89574	42.28405	55.03847
Skewness	0.358192	0.306667	0.333391	0.380432
Kurtosis	1.755438	1.745042	1.727579	1.757610
Jarque-Bera	9.193713	8.698646	9.200453	9.462575
Probability	0.010083	0.012916	0.010050	0.008815
Sum	18205.11	17719.09	16392.07	17974.91
Sum Sq. Dev.	332464.0	274579.9	189521.8	321098.7
Observations	107	107	107	107

Table 3: Descriptive Result
Source: Eviews 9.0

Table 3.1 presents the result of descriptive analysis of the variables used for this study. The result reveals the mean, median, maximum, minimum, standard deviation, skewness, kurtosis and Jarque-Bera statistics of the variables employed. The result of house price index reveals the mean value of 170.1412, median value of 157.9200, maximum value of 275.5000, minimum value of 96.92000 and the standard deviation value of 56.00404. The skewness value of HPI is 0.358192 implies that house price index is positively skewed, the new house price index reveals 0.306667 meaning that NHPI is positively skewed, hedonic house price index shows the value of 0.333391 indicating that HHPI is positively skewed while existing house price index shows the value of 0.380432 which implies that EHPI was also positively skewed. The Kurtosis statistics reveals that all the variables employed are platykurtic in nature that is they are less three (3). Meanwhile, the Jarque-Bera statistic value and its probability reveals that all the variables are not normally distributed during the study period.

4.2. Unit Root Test

The unit root testing is used to test the stationarity of the variable which is one of the requirements in regression analysis when using secondary data.

Variable	Augmented Dickey-Fuller test statistic	Critical values
HPI	3.091202	-2.889200
HHPI	1.418730	-2.889200
EHPI	0.063267	-2.892536
NPI	4.205182	-2.888932

Table 4: Unit Root Result @ Level
Source: Writer's compilation (2019)

The above table shows the Augmented Dickey Fuller unit root result at level and it reveals that none of the variables are significant at level which necessitated the study to proceed to first difference testing.

Variable	Augmented Dickey-Fuller test statistic	Critical values
HPI	-5.000349	-2.889200
HHPI	-4.605090	-2.889200
EHPI	-1.308830	-2.892879
NPI	-8.736879	-2.889200

Table 5: Unit Root Result @ First Difference
Source: Writer's compilation (2019)

The first difference testing of the Augmented Dickey Fuller unit test presented in Table 3.3 reveals that HPI, HHPI and NPI are stationarity while EHPI is not stationarity which necessitated to test EHPI at second difference testing.

Variable	Augmented Dickey-Fuller test statistic	Critical values
EHPI	-4.754929	-2.892879

Table 6: Unit Root Result @ second Difference
Source: Author's compilation (2019)

The table above shows that result of unit rooting testing of EHPI and it shows that EHPI is stationarity at second difference.

Variable	Order of Integration
HPI	I(1)
HHPI	I(1)
EHPI	I(2)
NHPI	I(1)

Table 7: Order of Integration
Source: Author's compilation (2019)

The order of integration of the unit rooting using Augmented Dickey Fuller testing is presented in Table 5. The result indicates that all the variables were of the same order excluding EHPI which was stationary at second difference while others variables such as HPI, HHPI and NPI were stationary at first difference which that the shocks from the variables were retain for a short period after which they let go.

4.3. Regression Analysis
The regression analysis is used to test the impact or effect of the independent variables on the dependent variable.

The result of the regression test is presented below

Dependent Variable: HPI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.886041	1.221872	-6.454065	0.0000
NHPI	0.416993	0.039888	10.45400	0.0000
HHPI	0.115156	0.061504	1.872343	0.0640
EHPI	0.543676	0.030841	17.62838	0.0000
R-squared	0.999874	Mean dependent var		170.1412
Adjusted R-squared	0.999870	F-statistic		271758.3
		Prob(F-statistic)		0.000000

Table 8: Regression Result
Source: Writer's Compilation (2020)

The above table revealed regression result of house price index used in Turkey. However, house price index was used as the dependent variable while the independent variables were hedonic house price index, new house price index and existing house price index. From the result, the coefficient of multiple determinant (R^2) is 0.999874 representing 99.98%; the adjusted R-square 99.98% which implies that the variables were nicely fitted and the F-test showed 271758.3 and its P-values were 0.000000 which implies that all the independent variables (HHPI, NHPI and EHPI) can jointly influence house price index.

The result of the equation reveals that the independent variables have negative sign that is house price index is negative at constant with 7.886041 coefficients. This means that when all variables are held constant, there will be a negative variation up to the tune of 7.886041 units in house price index and its P-value is 0. 0000. This means that, at constant there is a negative but significant effect of HHPI, NHPI and EHPI on house price index in Turkey during the study period.

From the table above, the regression coefficient of new house price index is 0.416993 and its P-values were 0.0000 indicating that NHPI has a positive and significant effect on house price index in Turkey and when NHPI increases with one unit, the house price index will positively increase with the value of 0.416993. The coefficient value of hedonic house price index is 0.115156 with p-value of 0.0640 implying that HHPI has a positive effect but it is not significant at 5% level of significance. That is, a unit increase in HHPI will lead to increase in house price but not significant. The coefficient value of existing house price index is 0.543676 and its p-value is 0.0000 showing that EHPI has a positive and significance effect on house price index in Turkey which also implies that a unit increase EHPI will spur house prices.

4.4. Post-Estimation Techniques
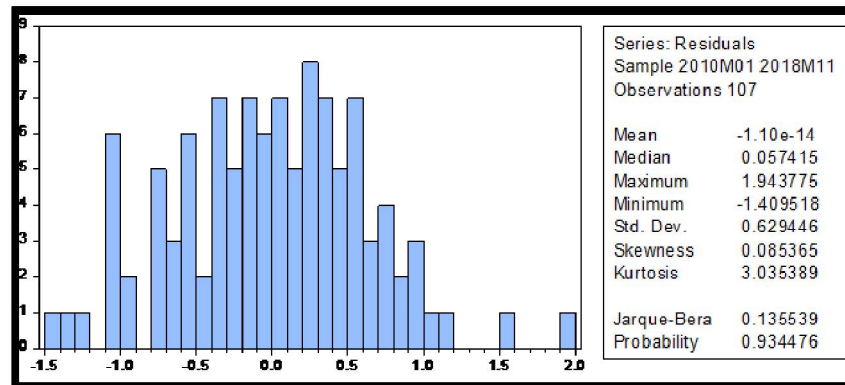
4.4.1. Normality Test

Figure 1: Normality Test Result
Source: Author's compilation (2019)

The result of the table reveals the Jarque-Bera value of 0.135539 with p-value of 0.934476 which implies that the p-value is more than 5% level of significance that means the variables are normally distributed during the study period.

4.4.2. Serial Correlation
This is used to obtain the connection between two or more proxies

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	37.99196	Prob. F(2,101)	0.0550
Obs*R-squared	45.93795	Prob. Chi-Square(2)	0.0610

Table 9: Serial Correlation Result
Source: Author's compilation (2019)

`One of the pre-conditions of regression analysis is that the variables should not be serially correlated and the result of the above table through the probability of Chi-square 2 shows that the value is more 5% level of significance which means that the variables employed are not serially correlated during the study period.

4.4.3. Heteroskedacity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	9.214426	Prob. F(3,103)	0.0000
Obs*R-squared	22.64051	Prob. Chi-Square(3)	0.0000
Scaled explained SS	21.35062	Prob. Chi-Square(3)	0.0001

Table 10: Heteroskedacity Test Result
Source: Author's compilation (2019)

However, another pre-condition of regression analysis is heteroskedastic testing and the condition says the variable should be homoscedastic and not heteroskedastic. Meanwhile, the result of the observe R-squared and its probability of Chi-square reveals that there is possibility of heteroskedastic among the variables and this is one of the requirements of repeat sales method.

5. Conclusion
The study examined the application of house sales methodology on real estate in Turkey. Meanwhile, repeat sales methodology has not been implemented in Turkey but there were other methods used for house sales which includes hedonic house price index, new house price index and existing house price index. However, the study concluded that new

house price index had a positive and significant effect on house price index in Turkey. It also concluded that hedonic house price index had a positive effect but it is not significant during the study period. Furthermore, it was concluded that existing house price index revealed a positive and significance effect on house price index in Turkey which also implies that a unit increase EHPI will spur house prices. In line with the findings, the study recommended that the government and the policy makers should introduce to emulate repeat sale method as discussed in the conceptual clarifications. It is also recommended that the new house price index and existing house price index should be encouraged by the government and the policy maker on real estate since their contributions are significance on house sales in Turkey.

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