

Housing Submarkets in Istanbul

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This study tests the hypothesis that in a segmented housing market, housing price structure is different in each segment and whole market area price structure does not reflect a realistic housing price structure effectively. Submarket existence is tested in order to average household income in neighbourhoods in the Istanbul housing market. Whether the consequential variations in prices in each segment have large effects on the overall prices of housing is emphasized by the replication of the Schnare and Struyk (1976) process. The empirical results show that as a stratifier, average household income in neighbourhoods affects housing prices in each segment and, considering the submarkets based on average household income in neighbourhoods, is an effective for the Istanbul housing market. Implicit attribute prices vary and there is a statistically significant difference in the prices of each segment. These differences have a large effect on the overall price of housing.

Key words

Housing submarkets; average household income in neighbourhoods; Istanbul

1. Introduction

Although it is widely argued that urban housing markets are segmented, this has not yet had begun to permeate all practical applications of house price modelling. With pronounced market segmentation, whole city analysis of housing prices becomes inappropriate. This paper aims to put forth that in a segmented housing market, housing price structure is different in each segment and the whole market area price structure does not reflect a realistic housing price structure effectively. Related to this, submarket existence was also tested in order to average household income in

neighbourhoods in the Istanbul housing market. It was expected that each potential submarket can be used to derive submarket specific hedonic equations. If there are large and significant differences in the estimated parameters of those equations, they should be viewed as evidence of market segmentation. If there are not, the market whole model is a relatively effective tool for explaining variation in housing prices. After determining the consequential variations in prices in each segment, it can be shown whether these differences have large effects on the overall price of housing.

At present, there are many house price studies that do not recognize the existence of segmentation. Arguably, this is because the available evidence has been collected for a disparate range of cities and in a variety of time periods. With the announced aim, this paper's empirical results contribute to this debate by introducing new evidence from the Istanbul market. There are many institutional and cultural reasons to expect that the Istanbul market might be different in structure from the widely studied North American and European markets.

Section 2 reviews the literature both in theoretical and empirical framework defining submarkets, identifying dimensions of them, and finally stratifiers have been used in identification. This is followed, in section 3, by a replication of the 3-step procedure for testing for submarket existence proposed by Schnare and Strunk (1976). After defining the potential housing submarkets of the Istanbul housing market, the whole market and potential submarkets' hedonic house price structures were estimated. It was shown that not only the significant price differences exist among potential submarkets based on average household income in neighbourhoods but also that the overall effects of these differences on price are big. Finally, in section 4, some conclusions are drawn.

2. Housing Submarkets

There has been an effort to define housing submarket since the 1930s. Assuming the existence of housing submarkets, they are cause for filtering models which are the earliest conceptual framework for applied studies. Contributions by Alonso (1964), housing submarkets become dominated by equilibrium models of the new urban economics. Hedonic house price literature has extended this neoclassical framework. Differing from hedonic studies, this literature emphasizes that the housing market may be in disequilibrium and that housing submarkets are the cause of the housing markets' disequilibrium (Whitehead and Odling-Smee, 1975). Despite the housing submarkets widely studied in a theoretical framework, there is no single and coherent definition of a housing submarket and there is little consensus as to how submarkets should be identified for applied housing studies.

In empirical studies, researchers have defined submarkets in different ways such as by demand and supply factors, geographical characteristics, spatial characteristics, structural characteristics and neighbourhood characteristics. Household income and race also defined submarkets in some studies. Watkins (2001) reviewed and summarized submarket definitions in four groups based on structural dimensions,

spatial dimensions, demander characteristics and the joint influence of structural and spatial characteristics of dwellings. Brouassa et al. (2003) summarized those definitions under two main groups as geographical areas and statistical techniques.

Not only does the definition of housing submarkets differ among empirical studies but also the dimensions that determine these submarkets. Researchers have offered different stratification schemes for their submarket definitions. Age, floor area, lot size, number of rooms, number of bathrooms, parking lot, elevator, wall material, roof material are given as examples of structural stratifiers. Socioeconomic characteristics, race, census boundaries, neighbourhood boundaries, municipal boundaries, school districts, inner and outer urban areas are examples of widely used elements of spatial dimensions. Income levels or household size in addition to neighbourhood boundaries or inner and outer urban areas or construction type (detached houses, semidetached houses, terraced etc.) is an example of stratifiers of joint influence.

Strasheim (1975) was the first to raise the question of market segmentation. Defining classes according to spatial characteristics in the San Francisco Bay, he accepted submarket existence. Even though Palm (1978), Sonstelie and Portney (1980), Gabriel (1984), Maclennan et al (1987), Michaels and Smith (1990) and Hancock (1991) defined submarkets based on spatial characteristics, their stratifiers are different. However, all of them accepted submarket existence in their study areas. Nevertheless, Ball and Kirwan (1977) couldn't find enough evidence to support submarket existence.

As alternative to spatial segmentation, Dale-Johnson (1982), Bajic (1985), Rothenberg et al. (1991) and Allen et al. (1995) proposed submarkets related to structural characteristics and all of them emphasized submarket existence in their studies. Emphasizing the joint importance of spatial and structural characteristics, Schnare and Struyk (1976), Goodman (1981), Adair et al (1996) and Maclennan and Tu (1996) all defined classes according to the joint influence of structural, spatial and demander group characteristics and they accepted submarket existence in their study areas.

In an attempt to avoid researcher bias, some researchers developed new approaches in terms of empirical and alternative modelling techniques to define submarkets. Jones et al. (2004) defined submarkets based on household mobility/intra-urban migration systems. In their studies, Maclennan et al. (1987), Bourassa et al. (2003) and Bourassa et al. (2005) let the data determine the submarkets. They employed principal component analysis and cluster analysis rather than a priori judgment. Zip code districts have frequently been used to identify submarkets (Goodman, 1981, and Goodman and Thibodeau, 2003). By applying neural network analysis Kauko et al. (2002), and by utilizing cellular automata and discrete choice models, Meen and Meen (2003) tried to define urban housing submarkets.

Within this structure, this paper proposes submarkets based on average household income in neighbourhoods as older middle-income areas, newer upper-income areas,

and low-income squatter settlements. This research is useful in gaining a better understanding of housing markets in a specific area by introducing new evidence from the Istanbul market.

3. Evidence from the Istanbul Housing Market

In this study, to test for submarket existence at a single point in time, the procedure that was introduced by Schnare and Struyk (1976) is utilized. As submarkets are not known in advance, the first step must be to determine whether segmentation exists. Second, if it is a segmented structure, it must be tested to see whether the resulting variation in prices is significant.

Schnare and Struyk (1976) defined this test procedure in three stages. First, they estimate hedonic house price functions for each potential market segment in order to compare these potential submarket prices. If there are large and significant differences in the estimated parameters of those potential submarkets, the differences might be accepted as evidence of market segmentation. Second, they compute the F-test to establish whether significant differences exist among the submarkets' specific prices. An F-test tests the hypothesis of strict price equality throughout the sample. It shows whether the parameters of the submarkets' house prices are equal or not. Third, since the primary interest is in the price of housing, rather than in the price of the individual housing attributes, the difference between whole market model and submarket models' regressions should be emphasized. Testing for the relative importance of this variation, the standard errors of the whole market model and submarket models can be compared¹. By replicating this process, it is possible to evaluate the ability of alternative submarket structures in the Istanbul housing market to delineate market outcomes.

The data is from a survey of 617 households' sampled to unspecified mix randomly, representing 3% of the market in 2001. The survey provides information about 1) the structural characteristics of the dwelling including number of rooms, floor area (m²), number of bathrooms, storey on which the unit is located, age, balcony, heating types, car parking, type of dwelling (attached, detached and block); 2) socioeconomic structure of the households such as family size, age profile, number of occupants, workplace and occupation, education profile and property ownership; 3) neighbourhood and location characteristics like accessibility to public spaces and

¹ Each submarket is represented by one sample. The formula calculating for the standard error of the submarket model can be written as follows:

$$SE = [(n_i - k_i - 1) / (N - K - 1)] * SE_i$$

where n_i is the number of units in the i th submarket and k_i is the number of explanatory variable in the i th submarket equation, and N is the number of transactions in the whole market and K is the number of explanatory variables in the market whole equation.

public transportation, safety, sufficiency of public facilities, environmental quality and average household income in the neighbourhood; 4) sale prices of dwellings of a given time period. After records with missing values are removed, the empirical results presented in this paper are based on the analysis of 522 complete records (Alkay, 2002).

3.1 The Potential Housing Submarkets of Istanbul

Istanbul is not only the largest city in Turkey, where 15% of the country's population resides, but also the most important economic center where over one fifth of the gross national product is produced. Although it has experienced decreasing population growth in the last years, its population has increased by an average of 4.5% every year since the 1950s. The inadequate housing areas are the most noticeable product of this rapid and continuous population increase.

Development of housing areas in Istanbul is associated with the city's historical, commercial and industrial development process. In addition to expanding housing developments, this process has encouraged a segmented structure of them. Planned and unplanned housing areas are the two main segments of the Istanbul housing market and planned housing areas represent 70% of the total whereas unplanned housing areas represent 30% of it.

The most important characteristics of planned housing areas, until the 1980s, were increasing building densities to accommodate the growing population. Since all housing development is in and around of central areas, this period's developments might be called inner-city developments. Most of those areas are old, attached units in high density areas in today and they offer insufficient infrastructure. They are occupied mostly by middle income groups. The 1980s is an important turning point in encouraging new developments of planned housing areas. Mass housing developments were supported widely in this period. Increasingly, the developing highway network has accelerated this development and these mass housing areas have rapidly occurred in different parts of the city. The first period of these fast and uneven developments can be called middle-city housing developments and the second period can be called outer-city housing developments. Today, they are relatively young; mostly block type and high density. However, there is sufficient infrastructure in these housing areas. They are occupied mainly by high income groups. In addition to planned housing areas, housing developments have also occurred in unplanned areas since the 1950s. These unplanned and illegal housing areas are called "gecekondu" (squatter settlement) and they scattered throughout the city. Almost 30 percent of all housing areas in Istanbul are "gecekondu" today. Low income groups occupy these inadequate living environments (Bilgin, 1992; Tekeli, 1994; Tekeli, 1998; Tekeli, 2000; Keyder, 2000; Başlevent and Dayioğlu, 2005).

As Straižheim (1975) emphasized, due to heterogeneity in the existing stock and the existence of discrimination the urban housing market is a set of compartmentalized and unique submarkets delineated by housing type and location. In this case, the historical development of Istanbul housing market and the housing stock, as a

product of this process, tend to reflect the potential housing market segments of the city. Therefore, in this study segments were defined along the line of this existing stock. Old, attached and middle income housing areas are the first segment. New, block and high income housing areas are the second segment. The squatter settlements are the last, third segment. Since the aim is not necessarily to define homogenous submarkets, but rather to segment the market in a way that allows for more accurate estimates of house values, three segments are used representing respectively 26 percent, 44 percent, and 30 percent of the Istanbul housing stock. Empirical results have quite broad implications regarding the overall functioning of those potentially distinct submarkets. This is a simplification of the city's housing markets and assumes that a solution with few submarkets is superior to a solution with many submarkets. Furthermore, it coincides with Brouassa et al. (2003) who emphasized that if a market is segmented into smaller and smaller submarkets the hedonic prices are estimated less precisely due to the inverse relationship between sample size and standard errors. Yet while other divisions might conceivably produce results that differ from this study, it may be said that the potential segments considered here are broad enough to capture any tendency toward market segmentation within the whole city market.

Analysis is applied to those three main potential segments of one particular housing market. Segmentation relied on average household income within these three potential submarkets and separate models are fitted to each of them. This stratifier was selected because 1) income was thought to have relatively inelastic demands when compared to other attributes of housing bundle and it has strong influence on location decision of households; 2) as marked by Tiebout (1991) and Mean and Mean (2003), individuals with similar economic profiles choose similar houses and the demand structure at segments and, consequently, price level differentiates each from the other while utility level for all consumers is the same. As being only the stratifier, average household income in the neighbourhood might be seen as short-cut way of segmentation. However, in the historical perspective, it coincides with the earlier definition of structural and spatial developments of housing areas. Relying on this characteristic in stratifying submarkets does not mean ignoring the other characteristics of the Istanbul housing market.

3.2 The Market-wide Model

Recall that this paper aims to examine whether housing price structure is different in each segment and whether the whole market area price structure reflects a realistic housing price structure in a specific area. As Bourassa et al. (2003) emphasized in their paper, since the focus of the paper is on the practical applications of housing submarkets, the hedonic approach is appropriate. Following Rosen (1974), housing can be considered as a set of features that, if considered separately, provides satisfaction for the user. In accordance with its heterogeneous nature, differences between the features influence price structures. Using the hedonic theory, not only the implicit price of each characteristic but also the influence of those characteristics on price structure can be estimated. This makes possible to undertake useful comparisons between the prices paid for different qualities and specifications of the

commodity. Since hedonic regressions provide opportunities to compare differences, it is widely used in submarket analysis.

In this section of the paper, by replicating Schnare and Struyk (1976) process, the empirical results of potential submarkets in explaining the price structure in the Istanbul housing market were compared. After defining the three potential submarkets, separate hedonic equations were estimated for the entire market and those three potential submarkets. Based on extensive exploratory analysis, variables were included in the analysis. Table 1 presents the variables, and Appendix 1 gives summary statistics describing their variation within the sample.

Table 1 Variable Names and Definitions

Variable	Coefficients
CNSTR	Dummy equal to 1 if the building structure is concrete
STRY	Storey on which the unit is located
FLOOR	Floor area of the dwelling (m ²)
ROOM	Number of rooms in dwelling
AGE	Age of the building on which the unit is located (month)
BATHRM	Dummy equal to 1 if there is more than 1 bathroom
HTNG	Dummy equal to 1 if heating system is working with natural gas
CARPRK	Dummy equal to 1 if there is a car park
BALCONY	Dummy equal to 1 if there is a balcony
INCOME	Average household income in the neighbourhood (YTL)
ATTACHED	Dummy equal to 1 if the building is attached
BLOCK	Dummy equal to 1 if the building is block
ENVQUALITY	Low environmental quality in the neighborhood
SOC-CULT	Distance (km) to social and cultural facilities
TRANSPORT	Distance (km) to public transportation

The first step in the testing procedure is the estimation of a hedonic model for the entire city-wide housing market. The model (table 2) represents house prices explained by a range of structural, location and neighbourhood characteristics. It gives the 'average' price function faced by house buyers in the Istanbul market during study period. In this equation some variables are entered in the form of dichotomous dummies which indicate the presence or absence of particular characteristic and some of them are entered as continuous variables (see table 1). For instance, BALCONY takes the value 1 to indicate the presence of a balcony. However, other variables such as FLOOR - floor area of the dwelling in square meters -, AGE - age in months of the building on which the unit is located - are entered as absolute values.

Many regressions were carried out to test different models. Table 2 gives the regression results for best model. It uses a linear form. This allows interpreting each

coefficient as the implicit price for each attribute. Thus, the presence of car parking (CARPRK) adds around 68,663 YTL² to the value of a standard dwelling.

Table 2 Hedonic Price Estimate for Istanbul

Variables	OLS		White corrected	
	Coeff	S.E.	S.E.	Prob.
Constant	-30778.779	9390.148	9000	0.000
STRY	2700.804	1464.922	2000	0.2
BATHRM	60993.261	9199.052	10000	0.000
HTNG	53818.116	8545.883	9000	0.000
CARPRK	68662.767	8410.522	10000	0.000
INCOME	48.539	2.223	4	0.000
ATTACHED	-18920.9	7480.10	8000	-0.02
	<i>Sample Size</i>	522		
	<i>Standart Error</i>	7609		
	<i>R²</i>	0.935		
	<i>Adjusted R²</i>	0.873		
	<i>F-value</i>	596.437		

The explanatory power of the model, the adjusted R^2 , is good at 0.873. Estimated model reported with its standard errors based on OLS and White test corrected standard errors. White test corrected standard errors are heteroscedasticity-robust and therefore offer a more realistic significance assessment of parameter estimates under heteroscedasticity (Can and Megbolugbe, 1997, Pryce, 2002). To minimize the problem of multicollinearity, a correlation matrix was computed and used as a guide in developing a robust model by eliminating variables which were closely correlated.

3.3 Potential Submarkets

The second step is estimating the hedonic price functions of the three potential submarkets based on average household income in neighbourhoods. A summary of the submarket-specific hedonic price functions is reported in Table 3; significant variables are highlighted. The submarket-specific regressions' explanatory powers, adjusted R^2 , are generally good, ranging from 0.526 to 0.783. In the equations, White's HC3 corrected standard errors were presented since the test for heteroscedasticity are not infallible and they may have missed an important source of systematic variation in the error term (Pryce, 2002, Can and Megbolugbe, 1997). Furthermore, since closely correlated variables were eliminated, the multicollinearity problem is minimized.

² Indicative average US Dollar exchange rate announced at a given time of period by the Central Bank of Turkey is 1.26 YTL.

Table 3 Hedonic Price Estimates for Submarkets

<i>Variables</i>	<i>First Segment</i>			<i>Second Segment</i>			<i>Third Segment</i>			
	<i>OLS</i>	<i>S.E.</i>	<i>White corrected</i>	<i>OLS</i>	<i>S.E.</i>	<i>White corrected</i>	<i>OLS</i>	<i>S.E.</i>	<i>White corrected</i>	
Constant	-69932.3	8938.638	9000	0.000	0.000	0.000	-7466.575	6933.322	7000	0.3
FLOOR	1143.972	118.959	200	0.000	0.000	0.000	199.331	70.235	70	0.004
BATHRM	17357.450	5644.138	6000	0.005	0.000	0.000	17736.929	5885.326	10000	0.07
INCOME	60.002	6.663	10	0.000	0.000	0.000	59.701	7.135	8	0.000
CARPRK	-	-	-	-	0.000	0.000	6472.590	3174.439	4000	0.07
ROOM	-	-	-	-	-	-	3995.745	1771.816	2000	0.02
BALCONY	-	-	-	-	-	-	8104.170	4311.135	5000	0.09
	<i>Sample Size</i>	<i>160</i>					<i>Sample Size</i>	<i>190</i>		
	<i>Standart Error</i>	<i>3681</i>					<i>Standart Error</i>	<i>2515</i>		
	<i>R²</i>	<i>0.787</i>					<i>R²</i>	<i>0.542</i>		
	<i>Adjusted R²</i>	<i>0.783</i>					<i>Adjusted R²</i>	<i>0.526</i>		
	<i>F-value</i>	<i>192.390</i>					<i>F-value</i>	<i>36.023</i>		

Adjusted R^2 values are lower (0.783 for first segment, 0.697 for second segment, and 0.526 for third segment) than for the market-wide models (0.873). All of the models have fewer variables in the equations. In comparison to the market-wide level of analysis, standard errors are lower for the first (3681) and third (2515) submarkets but higher for the second (10962) submarket. Such an outcome is not surprising given the differential price structure by potential segments (mean price for market wide 209,830 YTL; first segment 112,025 YTL; second segment 462,326 YTL; third segment 63,616 YTL).

Following the Schnare and Struyk process, after estimating hedonic equations, the F-test is done. F-test allows one to identify whether the submarkets' hedonic equations' implicit attribute prices are equal or whether significant differences exist. If the price differences are significant, then the posited submarkets are assumed to be appropriate, conditional on the particular specification of submarkets (Goodman and Thibodeau, 2003). The F-test results presented in Table 4 showed evidence of market segmentation based on average household income in neighbourhoods. By rejecting the hypothesis of absolute price equalities among submarkets, the F-test results show that differences in implicit prices exist among three potential submarkets. There is no evidence of parameter equality among these submarkets (see table 5.).

Table 4 ANOVA

Standardized predicted value	Sum of squares	df	F	Signifacance
Between groups	425.613	2	1157.880	0.000
Within groups	95.387	519		
Total	521.000	521		

Table 5 Multiple Comparisons for the 3 a priori Identified Spatial Submarkets

Dependent variable	Submarkets	Mean difference	Significance
Standardized predicted value 1	2	-1.6833644*	0.000
	3	0.3841851*	0.000
2	1	1.6833644*	0.000
	3	2.0675495*	0.000
3	1	-0.3841851*	0.000
	2	-2.0675495*	0.000

Note: * indicates significance at .05 level. Test results based on Scheffe test.

There is clear evidence of submarket existence and the implicit prices for attributes are not constant across even these potential submarkets. This is confirmed by the weighted standard error test results as well. In table 6, the results of the examination of whether the price differences observed pass Schare and Struyk's weighted standard error test are reported. This test shows the overall effects of differences, whether big or not. By computing weighted standard errors for the segmented

market models, it is apparent that the differences affect the overall variation in housing prices in all of these potential submarkets.

Table 6 Weighted Standard Error Rest

	Standard error	% reduction
Market-wide model (SE^c)	7609	
First submarket (SE_1^u)	1117	14.65
Second submarket (SE_2^u)	3562	46.72
Third submarket (SE_3^u)	895	11.74

There is no strict guidance on the size of the low threshold of evidence of significant overall variability in house prices for weighted standard error test. Schnare and Struyk accepted this threshold as 10 percent in their studies whereas Dale and Johnson (1982) suggested 5 percent. All of the three potential submarkets pass the weighted standard error test, even at the strictest level. As followed from the Table 6, the first, second and third submarkets achieved 15 percent, 47 percent, and 12 percent respectively.

Three important results can be seen from the empirical results. At first, if submarkets impact housing prices the factors that stratify submarkets would be expected to affect prices (Goodman and Thibodeau, 1998, 2003). It can be seen from submarket hedonic functions that, as a stratifier, average household income in neighbourhoods affects housing prices in each segment. In this case, considering the submarkets based on this characteristic is effective for the Istanbul housing market. Second, each result can be interpreted as evidence that implicit attribute prices vary and there is a statistically significant difference in the prices of the each segment. These differences had a large effect on the overall price of housing as well. Test results confirmed these three potential submarkets as three distinct submarkets of Istanbul, and the housing market in Istanbul is noticeably segmented. Third, related to the aim of the study, it was put forth that housing price structure is different in each segment and the whole market area price structure does not reflect the realistic housing price structure effectively in Istanbul.

4. Conclusions

This paper aims to demonstrate that in a segmented housing market, housing price structure is different in each segment and the whole market area price structure does not reflect a realistic housing price structure effectively. Related to this aim, submarket existence and price structure differences were tested in order to average household income in neighbourhoods in Istanbul housing market. Schnare and Struyk (1976) test procedure was replicated in this study.

Hedonic equations are robust and it is seen that both variables included in equations and their effects on housing prices are different in each potential segment. F-test results show that there is a significant coefficient difference, which reveals

significant price differences between submarkets, exists among those three potential submarkets. Standard error test confirmed this significant variation between market-wide and submarket housing prices. Istanbul housing market is a segmented structure in terms of average household income in neighbourhoods, and housing price structure is different in each segment.

Results are useful in gaining a better understanding of housing markets in Istanbul. They can provide a valuable basis for local market, newly developing mortgage market and policy analysis of this type. In practice, the results are important to identify mass appraisals for property taxation purposes. And, they contribute to the application of mass appraisal and standard index construction methods by real estate professionals.

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Appendix 1. Variable Descriptive Statistics

	Mean	Standart deviation
CNSTR	1.00	0.000
STRY	4.67	2.522
FLOOR	110.56	42.145
ROOM	3.69	0.751
AGE	220.82	118.512
BATHRM	0.31	0.462
HTNG	0.47	0.500
CARPRK	0.33	0.470
BALCONY	0.21	0.410
INCOME	2296.77	2292.091
ATTACHED	0.62	0.48471
BLOCK	0.37	0.48371
ENVQUALITY	0.00	1.000000
SOC-CULT	0.00	1.000000
TRANSPORT	0.00	1.000000