A SPATIAL ECONOMETRIC ANALYSIS ON THE DETERMINANTS OF REGIONAL HOUSING DEMAND[*]

Bölgesel Konut Talebinin Belirleyicileri Üzerine Mekansal Ekonometrik Bir Analiz

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Abstract

The aim of this research is to examine the determinants of regional housing demand in the NUTS-II regions of Turkey during the 2010-2017 period. It was decided to use the spatial econometric methods in the research analysis, since the presence of spatial effect which is arising from neighbourhood relationship between regions. The weight matrix was created within the framework of queen neighbourhood. According to the analysis findings, the income elasticity of regional housing demand varies between 0.790-1.400. In addition, it has been determined in the analysis findings that the price elasticity of regional housing demand is between 0.014-0.019. The fact that the price elasticity of regional housing demand is in a positive value range close to zero indicates that households perceive the house as an investment good as well as consumption good. The positive effect of regional industrialization level, regional population growth, and regional enterprise numbers on the regional housing demand is another finding obtained as a result of the research. As a result of the research, it is recommended that policy makers make policies to transfer their investment to industrial sectors that will create added value instead of the housing sector.

Keywords: Housing demand, regional analysis, spatial econometrics, housing price, NUTS II Regions

Jel Codes: O18, R21, R12

Öz

Bu araştırmanın amacı bölgesel konut talebinin belirleyicilerini Türkiye'nin Düzey II bölgeleri örneklemi üzerinde 2010-2017 döneminde incelemektir. Analiz bulgularında bölgeler arasında komşuluk ilişkisinden kaynaklanan mekânsal etkinin varlığı tespit edilmesinden dolayı araştırmada mekansal ekonometrik yöntemlerin kullanılmasına karar verilmiştir. Bu araştırmada ağırlık matrisinin oluşturulmasında komşuluk ilişkisine dayanan Vezir yöntemi tercih edilmiştir. Analiz bulguları bölgesel konut talebinin gelir esnekliğini 0.790 ile 1.400 aralığında değiştiği göstermektedir. Ayrıca analiz bulgularında bölgesel konut talebinin fiyat esnekliğinin 0.014 ile 0.019 aralığında olduğu tespit edilmiştir. Bölgesel konut talebinin fiyat esnekliğinin sıfıra yakın pozitif bir değer aralığında yer alması hanehalklarının konutu tüketim malının yanı sıra yatırım malı olarak da algıladığını göstermektedir. Bölgelerin sanayileşme düzeylerinin, nüfus artışlarının ve girişim sayılarının konut talepleri üzerindeki pozitif yönlü etkisi de araştırma sonucu ortaya çıkan bir diğer bulgudur. Araştırma sonucunda politika yapıcılara hanehalklarının yatırımını konut sektörü yerine katma değer üretecek sanayi sektörlerine aktarmasına yönelik politikalar üretilmesine dair önerilerde bulunulmaktadır.

Anahtar Kelimeler: Konut talebi, bölgesel analiz, mekansal ekonometri, konut fiyatı, Düzey II Bölgeleri

Jel Kodları: O18, R21, R12

1. Introduction

Housing is defined as a physical space that meet the need for shelter and is among the basic needs required for households to sustain their lives (Tatlı, 2013: 41). In addition to meeting the accommodation needs, housing has features such as being a production value, a consumption value, an investment value that gains from the increase in speculative attacks, and a cultural and sociological structural value. The housing, which contains these features, consists of social, economic, legal, cultural, and technological components and is the symbol of socio-economic status and prestige (Lebe and Akbaş, 2014: 58; Yılmazel et al., 2017: 2).

Housing demand, which is examined individually and socially, can also be evaluated in terms of consumption and investment. While the consumption part of the housing demand consists of household

income, prices and expectations, tastes and preferences, complementary and substitute goods; the investment part of the housing demand consists of housing production, organized housing market, financing policies, interest rates, inflation rates and housing policies (Öztürk and Fitöz, 2009: 25). Household income, obtained from production factors such as wages, profit, interest and rent, is one of the most important determinants of housing demand. The household makes a demand for housing for consumption and investment purposes with their level of income. A positive correlation is expected between household income and housing demand (Shefer, 1990: 266; Ermisch et al., 1996: 76,). In addition, due to the fact that the concept of flexibility is easy to understand, income elasticity has attracted great interest in housing demand (Shefer, 1990:266; Tse and Raftery, 1999: 123; Tandoh and Tewari,2016:160). Another variable that is effective in evaluating the housing demand policies is housing prices. The relationship between housing prices and housing demand differs according to the perception of the household as consumption or an investment property. There is a negative relationship between the housing demand and housing price in case the household buys the property for consumption purposes, while there is a positive relationship between the housing demand and house price in case the household buys the property for investment purposes (Solak and Kabadayı, 2016: 1132). Realistically, most households cannot separate housing consumption and housing investment for institutional or behavioral reasons. However, households displaying risk avoidance behavior demand housing for investment to capture the speculative increases in value due to the avoiding income risk and believing that house prices will continue to increase in the coming period (Davidoff, 2006: 210-212; Solak and Kabadayı, 2016: 1132).

Another economic variable that is thought to have a significant impact on housing demand after household income and housing price is income distribution. Gini coefficient is used to measure the inequality in income distribution. Gini coefficient, which takes values between 0 and 1, increases inequality as it approaches 1, and decreases inequality as it approaches 0. It is known that decreasing inequality in income distribution increases the average income levels of households.

Housing demands of the households, whose income levels increase as a result of the decrease in income inequality, also increases. Therefore, a negative relationship is expected between income distribution inequality and housing demand (Öztürk and Fitöz, 2009: 27-28). Another variable expected to have an impact on housing demand is the level of industrialization. Industrialization has turned big cities into centers of attraction due to its job opportunities and high living standards. Especially the development of the industry and service sector in the cities increased the migration from the rural and the cities with insufficient industrialization to industrialized cities. This influx of migration, which emerged as a result of industrialization to large cities, brought housing demand with it (Durkaya, 2002: 23).

In addition to economic factors, population growth and household components influence housing demand. Population growth which is one of these factors affects the demand for housing in terms of qualitatively and quantitatively (Tandoh and Tewari, 2016: 160). The economic and socio-demographic factors affecting the housing demand can vary between countries and even between regions of a country. This variability, especially between regions and settlements, attracted the attention of researchers and led them to focus on this issue (Akseki and Türkcan, 2016: 1873). Nese (1999) stated that the problems of the housing market may differ between regions. He stated that as a result of these differences, income elasticities and price elasticities of housing demand will differ between regions. Tse and Raftery (1999) stated that the income elasticities of housing demand between regions may be dissimilar. Horizontal section and panel data analysis are used in calculating the income and price elasticities of the housing demand of the regions. It is thought that there will be potential bias in estimating the income and price elasticities of the housing demand due to the fact that these analysis types do not take into account the spatial effect that reflects the interaction between the regions. To minimize this bias, spatial econometric methods should also be applied that take into account the interaction between neighboring regions (Liu, 2019: 70).
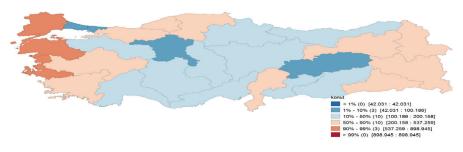
The impact of spatial effect, arising from the neighborhood relationship between the regions, on the housing demand of Turkey is

the main motivation of this research. Based on this basic motivation, the research has two goals. The first goal is to detect the determinants of housing demand in NUTS-2 regions of Turkey. The second is to reveal whether there is a spatial effect on regional housing demand.

The research consists of six parts including this introduction, which includes motivation and the goals. Following the introduction, the regional difference between the determinants of the housing demand is presented with the help of maps in the second part. In the third part, there is empirical literature to guide the research. Also in this part, the unique value of the research is revealed. In the fourth part, data and estimation methods to be used in the analysis are introduced. In the following part, the analysis findings of the research are included. In the last part of the research, there are evaluations and discussions based on analysis findings. Also in this part, suggestions are made to policy makers and researchers who are considering to research this issue in the future.

2. Determinants of Regional Housing Demand

The impacts of the housing sector, which has become the driving force of the economy in developed and developing countries, on regional economies are evaluated through regional housing demands. The fact that housing demands differ among regions indicates that the determinants of housing demand will also differ among regions. In this research, the difference in housing demand between regions is presented in Figure 1, which shows the percentage change between home sales from 2010 to 2017.

Figure 1: The Percent Change Housing Demand of NUTS-2 Regions

Source: TurkStat

According to Figure 1, the percent change of housing demand in the Western and Eastern NUTS-2 regions of Turkey is above the average of Turkey. The housing demand of TR21 (Tekirdağ, Edirne, Kırklareli), TR22 (Balıkesir, Çanakkale) and TR31 (İzmir) regions, where located on the western coast of Turkey, shows more than five times increase between 2010 and 2017. Less than fifty percent housing demand increase is observed between 2010 and 2017 in the regions where there are metropolises such as Istanbul and Ankara. Whether the variation in regional housing demands is in line with the determinants of regional housing demands is clarified with comparing Figure 1 to maps which reflect the percent changes in per capita income levels, the percent change in the housing price indices, the percent change in the population, the percent change in the number of enterprises and the percent change in the number of employment in the industrial sector between 2010 and 2017. Percent change in per capita income of NUTS-2 regions are presented in Figure 2.
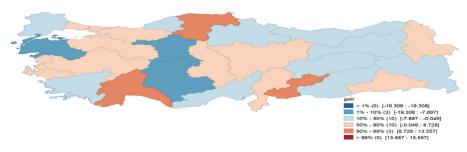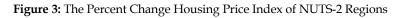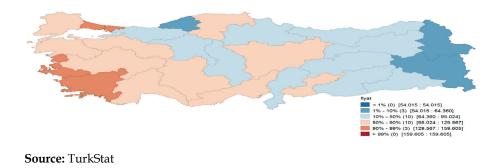
Figure 2: The Percent Change Per Capita Income of NUTS-2 Regions

Source: TurkStat

According to Figure 2, there is no significant difference between the Western and Eastern regions of Turkey in terms of percent change per capita income. The highest increase in percent of per capita income is observed in TR61 (Antalya, Isparta, Burdur), TR82 (Kastamonu, Çankırı, Sinop), TRC1 (Gaziantep, Adıyaman, Kilis) regions, while the least is observed in TR22 (Balıkesir, Çanakkale), TR51 (Ankara), TR52 (Konya, Karaman) regions. There is no remarkable similarity between Figure 2 and Figure 1. However, the percent increase of housing demand and the percent change of per capita income in regions, where Ankara and Konya are located, under the average of Turkey is the similarities that gained as a result of comparing Figure 1 and Figure 2. The map reflecting the percent change of housing price index, which is one of the important determinants of housing demand, is given in Figure 3.

Figure 3: The Percent Change Housing Price Index of NUTS-2 Regions

Source: TurkStat

According to Figure 3, there are serious differences between the Western and Eastern regions of Turkey in terms of percent change of housing prices. The percent change of housing prices in Western regions of Turkey is above the average of Turkey, while the percent change of housing prices in Eastern regions of Turkey is under the average of Turkey. The highest increase in percent change of housing prices is realized in TR10 (İstanbul), TR31 (İzmir), TR32 (Aydın, Denizli, Muğla) regions, while the least increase is realized in a region located on the eastern border of Turkey. As a result of the comparison of Figure 1 and Figure 3, it can be mentioned that there is a negative relationship between the percentage change in the housing demand and the percentage change in the housing prices of the region where Istanbul is located. However, the percent change in housing demand of TR31 and TR32 regions is similar to the percent change in housing prices of TR31 and TR32 regions. Therefore the percent change in housing prices of these regions is above the average of Turkey. It shows that a significant part of the housing demand in the these regions is realized for investment purposes. The map that reflects the percentage change of the population, another determinant of housing demand, is shown in Figure 4.

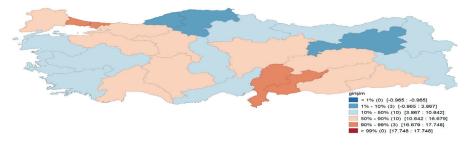**Figure 4:** The Percent Change Populations of NUTS-2 Regions

Source: TurkStat

According to Figure 4, there are significant differences between the Western and Eastern regions of Turkey in terms of the percent change in the population. The highest percent change of the population is experienced in TR21 (Tekirdağ, Edirne, Kırklareli), TR42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova), TRC2 (Diyarbakır, Şanlıurfa) regions,

while the least percent change of the population is experienced in TR81 (Zonguldak, Bartın, Karabük), TRA1 (It is lived in Erzurum, Erzincan, Bayburt), TRA2 (Ağrı, Kars, Iğdır, Ardahan) regions. The similarity between the percentage changes in the housing demand of the TR21 and TR42 regions and the percentage changes in their population is determined as a result of the comparison of Figure 1 and Figure 4. Based on this finding, it can be said that the increase in housing demand in the TR21 and TR42 regions may be due to the population increase. The percent change in the number of enterprises, which is one of the factors affecting the housing demand, is presented in Figure 5.

Figure 5: The Percent Change Enterprise Numbers of NUTS-2 Regions

Source: TurkStat

According to Figure 5, there are no remarkable differences between the Western and Eastern regions of Turkey in percent change of enterprise number. The highest increase in the number of enterprise number is observed in TR10 (Istanbul), TR63 (Hatay, Maraş, Osmaniye), TRC1 (Gaziantep, Adıyaman, Kilis) regions, while the least is observed in TR81 (Zonguldak, Karabük, Bartın), TR82 (Kastamonu, Çankırı, Sinop) regions. The percent change of employment in the industry sector, another economic determinant of housing demand, is given in Figure 6.

Figure 6: The Percent Change Employment in Industrial Sectors of NUTS-2 Regions

Source: TurkStat

According to Figure 6, there is no important distinction between the Western and Eastern regions of Turkey regarding the percent change of employment in the industrial sector. Figure 6 shows the highest percent change of employment in the industry sector is observed in TR10 (Istanbul), TRB2 (Van, Bitlis, Muş, Hakkari), TRC2 (Diyarbakır, Şanlıurfa) regions, while the least percent change of employment in the industry sector is observed in TR81 (Zonguldak, Bartın, Karabük), TR90 (Trabzon, Ordu, Rize, Giresun, Gümüşhane, Artvin), TRA1 (Erzurum, Erzincan, Bayburt) regions. As a result of the comparison of Figure 1 and Figure 6, it can be interpreted that the percentage changes in the housing demands of the TRB2 and TR90 regions parallel to the percentage changes of those employed in the industry sector.

3.Literature

There are many researches in the literature where housing demand is analyzed by the help of different econometric methods using aggregate data, regional data, and household data regarding the housing market. Durkaya (2002), Lebe and Akbaş (2014) used aggregated data, while Akseki and Türkcan (2016), Liu (2019) used regional data to research on the housing market. Some of the popular researches regarding the determinants of housing demand in the literature are outlined below:

Durkaya (2002), analyzed the determinants of housing demand in Turkey during the 1964-1997 period by using the co-integration method. According to the analysis findings, there is a positive relationship between per capita income and housing demand. In addition, the analysis findings point out the existence of a negative relationship between housing costs and housing prices with housing demand. In addition, the positive correlation between demographic variables and housing demand is another finding obtained from the analysis.

Fernandez-Kranz and Hon (2006), estimated the income elasticity of housing demand by using the least squares method, with the help of the annual data of the fifty cities of Spain between 1996-2002. Analysis findings show that income growth plays a weak role in housing price increases. In addition, according to the analysis findings, the income elasticity of the housing demand was estimated between 0.70 and 0.95.

Öztürk and Fitöz (2009), analyzed the determinants of housing supply and demand in Turkey during the 1968-2006 period by using the regression methods. According to the analysis findings, there is a positive relationship between per capita income, housing prices, and interest rates with housing demand. In addition, a significant relationship was not found between demographic factors and housing demand in the analysis findings.

Holly et al., (2010) analyzed the income elasticity of the housing price using panel and spatial panel methods, with the help of annual data of 49 states in the United States in the period 1975-2003. According to the analysis findings, there is a cointegration relationship between per capita income and real housing prices. In addition, the analysis findings point to the presence of a significant spatial effect.

Lebe and Akbaş (2014), analyzed the determinant of housing demand by using the co-integration method with the help of the annual data of Turkey in the 1970-2011 period. According to the findings, per capita income, marital status and industrialization affect housing demand positively, while housing prices, interest rates and

employment in the agricultural sector affect housing demand negatively.

Akseki and Türkcan (2016), analyzed the relationship between regional migration, unemployment and housing demand by using the panel data method with the help of annual data of NUTS-3 regions in Turkey for the 2008-2013 period. According to the analysis findings, there is no causal relationship between regional migration and regional unemployment, while there is a causal relationship between regional migration and regional housing demand.

Solak and Kabadayı (2016), analyzed the determinants of housing demand by using ARDL methods with the annual data of Turkey for 1964-2014 period. The positive impact of population growth, per capita income and housing prices on the housing demand was determined in the findings. In addition, according to the findings, the most determining variable on the demand for housing is the per capita income. The positive relationship between housing price and housing demand shows that the households residing in Turkey perceive housing as investment goods rather than consumption goods.

Liu (2019) analyzed the income elasticity of housing demand using the annual data of 144 local government units in Australia between 1991-2015 by panel data and cointegration methods. Findings show the existence of a one-way Granger causality relationship from income to house price. In addition, according to the findings, the income elasticities of the housing demand of Sydney and surrounding regions are higher than the income elasticities of the housing demand of the domestic and rural areas.

When the researches in the literature are examined, it is seen that the general trend towards the impact of per capita income, population growth and migration on housing demand is positive. However, there are different opinions regarding the relationship between the housing price and housing demand. Öztürk and Fitöz (2009), Solak and Kabadayı (2016) found a positive relationship between housing price and housing demand, while Durkaya (2002) found a negative relationship between housing price and housing demand.

Literature consists of research examining the housing demand in Turkey and foreign countries sample. In addition, all researches examining the housing demand on a regional basis are included in the literature. The literature draws attention to the lack of regional research on the factors affecting housing demand in Turkey.

Besides the lack of regional researches, the scarcity of researches to investigate the spatial effect in the regional housing demand was the determining factor in the selection of the research subject. The determinants of regional housing demand is analyzed panel data and spatial econometric technics in this research.

The weight matrix calculated to determine the presence of spatial effect in regional housing demand was created by the Queen criterion. Queen criterion accept that two regions are neighbour if they have a common boundary (Arbia, 2014:44). While there is research in the literature examining regional housing demand in the NUTS-2 sample with spatial econometric technics based on one year. Hovever, panel spatial econometric research based on more than one year have not been found in the literature yet. This gap constitutes the main motivation of the research.

4. Data Set and Model

The econometric model in the researches of Lebe and Akbaş (2014) was taken as a reference in estimating the regional determinants of the housing demand. However, the model of the research was created by subtracting interest rate, non-agricultural employment, and marital status variables from the reference econometric model. The econometric model created for the research was analyzed in the NUTS-2 regions sample. The fact that interest rate and marital status do not differ between regions is the reason for excluding these variables from the econometric model of the research. Since the employment level in the industrial sector reflects the industrialization level better than non-agricultural employment, the number of employment in the industrial sector is included in the econometric model of this research The econometric estimation model of the research is given in the equation below.

$$lhou_{it} = \beta 0_{it} + \beta 1linc_{it} + \beta 2lpri_{it} + \beta 3lind_{it} + \mu_{it} \tag{1}$$

The model in the equation number (1) constitutes the basic model of the research for the regional determinants of the housing demand. Models (2) and (3) have been created to check whether model (1) gives consistent results.

$$lhou_{it} = \beta 0_{it} + \beta 1linc_{it} + \beta 2lpri_{it} + \beta 3lpop_{it} + \mu_{it} \tag{2}$$

$$lhou_{it} = \beta 0_{it} + \beta 1linc_{it} + \beta 2lpri_{it} + \beta 3lent_{it} + \mu_{it} \tag{3}$$

Unlike Equation (1), $lpop_{it}$ is used in Equation (2) instead of $lind_{it}$. Also $lent_{it}$ is used in the Equation (3) instead of $lind_{it}$. The definitions and sources of the variables used in the models are shown in Table 1.

Table 1: Definitions and Sources of Variables

Variables	Definitions	Source
$lhou_{it}$	The logarithm housing sales of NUTS-2 regions in Turkey	TurkStat
$linc_{it}$	The logarithm per capita income of NUTS-2 regions in Turkey	TurkStat
$lpri_{it}$	The logarithm housing price index of NUTS-2 regions in Turkey	Cental Bank of Turkey
$lind_{it}$	The logarithm number of employment in industrial sectors of NUTS-2 regions in Turkey	TurkStat
$lpop_{it}$	The logarithm population of NUTS-2 regions in Turkey	TurkStat
$lent_{it}$	The logarithm enterprise numbers of NUTS-2 regions in Turkey	TurkStat

The variables in Table 1 were compiled from TurkStat and Central Bank databases. The onset year of this research analysis was determined 2010 since the data of the regional housing price index is not accessible before 2010. In addition, the ending year of this research analysis was determined 2017 since the data of regional enterprise number is not embraced in 2018. As a result, the determinants of housing demand in NUTS-2 regions of Turkey during the 2010-2017 period is analyzed by panel data and spatial econometric technics.

The standard econometric models based on the assumptions that the observations are independent from each other and the variance is constant, do not take into account the spatial effect resulting from the interaction between the regions. In the case of determining

dependency between observations, these assumptions cease to be valid and the estimation results made by econometric methods built on this theorem deviate and inconsistent (Aydıner, 2016: 46). Spatial econometric technics have been developed to solve neighborhood relations between the regions to overcome this obstacle. Spatial econometrics are methods that estimates the effect of independent variables on the dependent variable, taking into account the relationship between the locations to which the observations belong (Elhorst, 2014: 1-2).

In the data collected on the basis of settlements such as region, province and district, two main problems can be encountered: spatial dependence and spatial heterogeneity. Spatial dependence is defined as covariance and correlation between observations at different locations or points in space (Zeren and Savrul, 2012: 4757). Spatial heterogeneity is the coefficients and residues in the model vary depending on the location (LeSage and Pace, 2009: 29). Spatial dependence determined by the least squares method is listed in three different ways. The first one is the spatial lag model, where the lag term is located on the right side of the model as an independent variable. The second is the spatial error model in which spatial dependency is included in the error terms. The spatial error model shows the existence of the relationship between the error terms in different spatial units. The third is the spatial Durbin model, where spatial dependence is included in the independent variables of the model (LeSage and Pace, 2009: 28). Determining the most appropriate model for the research, the findings of the LM and bootstrap LM tests, which obtained by analyzing the model with the least squares estimator together with the weight matrix created with the neighborhood relationship, are used.

Maximum likelihood, generalized momentum methods (GMM) and instrumental variable estimators are used for estimating model by spatial econometric technics. The pooled panel data models are prefered in the absence of unit effect. The spatial fixed effect is used in case unobservable variables is included in the constant of the models, while the random spatial effect is used in case unobservable variables is included in the error term of model (Yılgör, 2019: 94). However, the

fixed effect spatial panel data model is used in the research due to the Elhorst's (2014) opinion that fixed effects estimator will provide more consistent result than the random effects estimator when using the regional data. The mathematical expressions of fixed effect spatial lag model and fixed effect spatial error model are given (Gülel, 2015: 156):

$$Y_{it} = \rho W Y_{it} + \beta X_{it} + \mu + \varepsilon_{it} \tag{1}$$

$$Y_{it} = \beta X_{it} + \mu + \emptyset_{it}, \ \emptyset_t = \lambda W \emptyset_t + \varepsilon_t \tag{2}$$

Equation 1 represents the fixed effect spatial lag model, while Equation 2 represents the fixed effect spatial error model. ρ is the spatial autoreggresive parameter in the fixed effect spatial lag model. λ is the spatial error coefficient in the fixed effect spatial error model.

5. Emprical Analysis and Findings

In the first stage of the analysis, the weight matrix was included in the models. Then the models were analyzed by least squares estimator. The spatial effect was determined in the findings of the LM and robust LM tests. The findings of the LM and robust LM tests are summarized in Table 2.

Table 2: Spatial Dependence Test Results

LM Tests	Equaiton (1)		Equaition (2)		Equation (3)	
	Stat. Value	Prob.	Stat. Value	Prob.	Stat. Value	Prob.
LM_G	48.768	0.000	42.735	0.000	35.965	0.000
$LM_G *$	0.001	0.922	0.604	0.437	0.142	0.707
LM_H	74.680	0.000	75.273	0.000	64.064	0.000
$LM_H *$	25.922	0.000	33.143	0.000	28.240	0.000

Note: * represents the resistant form of the LM test.

The findings of the LM test points out the presence of spatial error and spatial lag in the models of research. Therefore, robust forms of LM tests were examined. In the robust forms of the LM test, the presence of spatial lag cannot be detected, while the presence of spatial error is detected. Therefore, it is thought that the most consistent results for the research will be obtained with the fixed effects spatial

error estimator. The fixed effect spatial error estimation results of the research models are presented in Table 3.

Table 3: Spatial Analysis Findings

Variables	Equation (1)	Equation (2)	Equation (3)
$lpri_{it}$	0.014 (8.135) [0.000]	0.014 (8.214) [0.000]	0.017 (9.769) [0.000]
$linc_{it}$	1.044 (5.309) [0.000]	1.400 (8.262) [0.000]	0.790 (4.175) [0.000]
$lind_{it}$	0.964 (9.285) [0.000]		
$lpop_{it}$		0.857 (9.677) [0.000]	
$lent_{it}$			0.945 (10.908) [0.000]
λ	0.649 (11.659) [0.000]	0.620 (10.559) [0.000]	0.613 (10.314) [0.000]
LR	104.528 [0.000]	199.934 [0.000]	147.545 [0.000]

Note: Asymptotic t statistic values are given in brackets, probability values are in closed brackets. LR represents likelihood ratio, λ spatial error term, W weight matrix.

According to Table 3, regional per capita income has a positive effect on regional housing demand in all models of the research. Income elasticity of regional housing demand ranges from 0.790 to 1.400. The positive effect of the housing price index on the regional housing demand is determined in Table 3. According to Table 3, the price elasticity of regional housing demand ranges from 0.014 to 0.017. The fact that the price elasticity of regional housing demand has positive values close to zero indicates that the household perceives the housing as a investment good as well as perceiving it as a consumption good. In short, housing for households is considered not only for consumption purposes, but also as an investment tool against income risk and speculative value increases. In addition, Table 3 indicates the positive effect of the regional industrialization level on the regional housing demand. In the second model, which was established in order

to control the results of the first model, the increase in the regional population has a positive effect on the regional housing demand. The number of regional entrrerprises has a positive effect on regional housing demand. Moreover, Table 3 show that the strongest impact on regional housing demand is regional per capita income. Analysis findings of the second and third models confirm the findings of the first model. In addition, the spatial effect was determined in all three models and the direction of this effect was found to be positive. LR values show that fixed effect spatial error is more valid than the classical model.

6. Conclusion

In this research, the factors determining housing demand in NUTS-2 regions of Turkey during 2010-2017 period is analyzed spatial panel data technics. The weight matrix was created within the framework of Queen neighbourhood in this research which the presence of spatial effect on regional housing demand is investigated.

The findings indicate that the spatial effect was found in all three models of research. The existence of spatial effect means that there is an interaction between neighbours. This interaction is based on the change in the housing demand of neighbouring regions creating an externalities in the region itself. This situation shows that economic policy related to only one region can affect other regions through socioeconomic interactions. This interaction also causes the OLS estimates to be inconsistent and biased for this research. Therefore the fixed effect spatial error estimator is used for this research. According to the findings, the income elasticity of regional housing demand varies between 0.790 and 1.400. These findings support the findings of Lebe and Akbaş, Solak and Kabadayı (2016). In addition, findings show that the price elasticity of regional housing demand ranges from 0.014 to 0.017. While these findings contradict the findings of Lebe and Akbaş (2014) in the literature, they support the findings of Öztürk and Fitöz (2009), Solak and Kabadayı (2016). The fact that regional housing demand has a positive value close to zero indicates that households perceive the housing as both consumption and investment goods. Households consider housing as an investment tool against the risk of

spatulative appreciation and income risk. However, according to the findings, the regional industrialization level has a positive effect on the regional housing demand. The positive effect of regional population growth and the number of regional enterprises on the housing demand is another findings obtained from the research. This findings show the relationship between socio-demographic factors to regional housing demand. If the region receives immigration, the housing demand of the region increases. Findings indicate that the second and third model which are established to control the basic model of this research, confirm first model findings.

As a result of the research, policy makers are suggested to produce policies to direct household investment to sectors that produce added value instead of housing. In addition, housing demand will be increased in the low socio-economic development level regions by investing in the industry sector in these regions. Migration movement between low and high socio-economic development level regions can be reduced these policies. A significant part of the variables used in the researches in the literature could not be included in the study since the regional data of 2010-2017 could not be accessed. Researchers who are interested in researching this issue in the future may offer a different solution to this issue with more comprehensive models and updated data.

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