DETERMINANTS OF REGIONAL HOUSING PRICES IN TURKEY

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by
Hilal ÖZDOĞAN

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We approve the thesis of **Hilal ÖZDOĞAN**

Examining Committee Members:

Assoc. Prof. Dr. Hasan Engin DURAN
Department of City and Regional Planning, İzmir Institute of Technology

---

Prof. Dr. Evrim TURGUTLU
Department of Economics, Dokuz Eylül University

Assoc. Prof. Dr. Koray VELİBEYOĞLU
Department of City and Regional Planning, İzmir Institute of Technology

20/12/2017

Assoc. Prof. Dr. Hasan Engin DURAN
Supervisor, Department of City and
Regional Planning, İzmir Institute of Technology

Assoc. Prof. Dr. Fatma ŞENOL
Head of the Department of
City and Regional Planning

Prof. Dr. Aysun SOFUOĞLU
Dean of the Graduate School
of Engineering and Sciences

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ABSTRACT

DETERMINANTS OF REGIONAL HOUSING PRICES IN TURKEY

In the literature on regional housing prices, two main groups of determinants are primarily put forward; speculative and fundamental variables. Empirical literature in this field has several shortcomings. First, although existing studies have analyzed the role played by speculative factors, none of the studies, have measured precisely the relative importance of speculative and fundamental variables. We aim at doing this. Moreover, the literature has measured the speculation only by analyzing backward-looking behavior. We improve this analysis by considering also forward-looking expectations. Second, in terms of cross-regional determinants, literature has largely considered economic and demographic variables whereas; geographic, urbanization and cultural variables have been ignored. We intend to incorporate them. Hence, aim of this paper is to understand the dynamics behind the housing prices in 26 Turkish regions between 2010:1-2016:9. We employ range of econometric methods such as Vector-Autoregressions, Unit Root Analysis, Cholesky Forecast Error Variance Decompositions, Impulse-Response Functions, Panel Regressions, Lagrange Multiplier Spatial Dependence Tests and Granger Causality Tests. As an outcome, three results emerge. First, housing price appreciations are so heterogeneous across regions. Second, role of speculative behavior is quite significant. Third, regions which have high urbanization, population, crime rate, trade openness, vehicle ratio, seaside and cultural activity ratios experience faster housing appreciations.

ÖZET

TÜRKİYE'DE BÖLGESEL KONUT FİYATLARININ BELİRLEYİCİLERİ

Bölgesel konut fiyatları hakkındaki literatürde spekülatif ve temel değişkenler olmak üzere 2 ana grup ön plana çıkmaktadır. Ancak, bu alandaki literatür çeşitli eksikliklere sahiptir. İlk olarak, mevcut çalışmalar spekülatif değişkenlerin rolünü incelemiş olmasına rağmen, hiçbiri spekülatif ve temel değişkenlerin oransal önemini kesin olarak ölçmemiştir. İlk amacımız bunu yapmaktır. Dahası, literatürde spekülasyon sadece geriye dönük fiyat davranışları ele alınarak ölçülmüştür. Biz bu analizi geliştirmek için ileri dönük beklentileri de ekleyerek bu analizi geliştirdik. İkinci olarak, literatürde bölgeler arası belirleyiciler açısından daha çok ekonomik ve demografik değişkenler üzerinde durulmuş, coğrafi ve kültürel değişkenler göz ardı edilmiştir. Bunları çalışmamıza dahil etmeyi hedefledik. Bu nedenle, bu çalışmanın amacı 2010:1-2016:9 zaman aralığında, Türkiye'deki 26 bölgede konut fiyatlarının ardındaki dinamikleri anlamaktır. Çalışmamızda, Vektör Oto-Regresyonları, Birim Kök Analizi, Cholesky Tahmini Hata Dağılımı Ayrıştırmaları, Etki-Tepki Fonksiyonları, Panel Regresyonları, Lagrange Çarpanı Mekansal Bağımlılık Testleri ve Granger Nedensellik Testleri gibi ekonometri yöntemleri kullanılmıştır. Çalışmanın sonunda, 3 önemli sonuç ortaya çıkmıştır. İlki, konut fiyat değişimlerinin bölgeler arasında oldukça farklılık göstermekte olduğudur. İkinci olarak, konut fiyat artışları üzerinde spekülasyonun etkisi oldukça önemli bulunmuştur. Üçüncü olarak, şehirleşmenin, nüfusun, suç oranının, ticari açıklığın, araç yoğunluğunun, sahil uzunluğunun ve kültürel aktivitelerin fazla olduğu bölgelerde, konut fiyatlarının çok daha hızlı artış gösterdiği bulunmuştur.

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ADF Test: Augmented Dickey Fuller Test

ANN: Artificial Neural Network

CBTR: Central Bank of Turkish Republic

CCI: Consumer Confidence Index

ECVAR: An Error Correction Vector Auto-Regressive

FAVAR Model: A Factor-Augmented Vector Autoregressive Model

GDP: Gross Domestic Product

GNP: Gross National Product

GVA: Gross Value Added

HPI: Housing Price Index

LSDV: Least Squares Dummy Variable

NUTS 2 Levels: 26 Nomenclatures of Units for Territorial Statistics

OECD: The Organisation for Economic Co-operation and Development

OLS Model: Ordinary Least Squares Model

PVAR: Panel Vector Auto-Regression Model

TURKSTAT: Turkish Statistical Institute

U.S.: United States

VAR Analysis: Vector Auto-Regression Analysis

VECM: Vector Error Correction Model

CHAPTER 1

INTRODUCTION

Regional housing price dynamics is a critical research subject for economists, planners and economic geographers which has economic, political, geographic and social consequences. This subject, indeed, has been examined since 1940s, in order to understand why some regions in a country experience greater housing price appreciation, compared to other regions.

In the related literature, housing price dynamics are mainly examined in 2 group of variables as fundamental and speculative determinants, even if, most of studies generally deal with only fundamental determinants (Himmelberg et al., 2005; Mallick and Mahalik, 2015). Although, fundamental determinants include demand-side and supply-side variables in the literature; demand-side variables are studied predominantly.

On the one hand, housing demand is analyzed by both aggregate variables (i.e. changes in mortgage interest rates, credit availability, money supply, exchange rate, property tax rates, share price index) and region specific variables such as income level of regions, wealth, employment growth, inflation, population, city size, net migration, household size, life expectancy, urbanization rate and trade openness of regions (Abraham and Hendershott, 1994; Apergis and Rezitis, 2010; Baffoe Bonnie, 1998; Blumenfeld, 1944; Capozza et al., 2002; Eaton and Eckstein, 1997; Goetzman and Volaitis, 2006; Hausman and Wise, 1980; Kearl, 1979; Lee, 1963; Mallick and Mahalik, 2015; Mankiw and Weil, 1989; Poterba, 1991; Smith and Tesarek, 1991; Öztürk and Fitöz, 2009; Wang et al., 2011).

On the other hand, housing supply is examined by the changes in interest rate, construction costs, regional inflation rate, income, land availability, credit availability, financial return of alternative investment options (gold, stock prices etc.) and changes in the dwelling stock (Chan, 1999; Dipasquale, 1999; Mallick and Mahalik, 2015; Mamre, 2014; Potterba, 1991; Topel and Rosen, 1988).

In addition to fundamental determinants (demand and supply side) speculation has also a major role on the housing price appreciation. The attention of researchers on speculation has increased after 2007 the Global Financial Crisis in U.S. is during which

a housing price bubble occurred due to failure in the mortgage system. Briefly, the lower mortgage interest and inflation rates lead to decrease in purchase cost of a house; thus demand of housing increased. Meanwhile, housing prices have a great appreciation with the help of this increased demand which have already risen with the shift of capital to housing sector after 2000s (Kutlu and Demirci, 2011). Besides, this situation results in an increasing demand for housing as an asset (to obtain higher expected future return) and speculation and asset bubble has arisen (Case and Schiller, 1988; Leamer, 2007).

In the literature, speculation factor is analyzed by using backward-looking adaptive expectations behavior. For instance, once housing prices start increasing in a region, this causes further appreciation in that area. This herding behavior occurs because individuals prefer more buying the properties in these regions since they expect a higher value increase in the future (Capozza and Sequin, 1996; Capozza et al., 2002; Levin and Wright, 1997; Mallick and Mahalik, 2015). This behavior is termed backward-looking expectation as individuals decide buying the properties by analyzing the former changes in housing prices (Capozza and Sequin, 1996; Capozza et al., 2002).

As another point, the levels of variables are generally argued in the literature in order to conduct more suitable determinants of housing prices. Considering this, some scholars claims that macro/national determinants are more useful to give an opinion on housing prices and develop macro policies (Hekman, 1985; Karakozava, 2004), while other researchers assert that micro/regional variables more appropriate in order to provide depth insights in the analysis (Mallick and Mahalik, 2015; Oikarinen, 2009). Furthermore, it is criticized that although housing prices are based on local dynamics, theorists are largely have concentrated on the macro determinants which are common to every location in a country and there is only a few studies on regional or micro determinants (Kundu, 1997; Oikarinen, 2009; Tiwari and Parikh, 1997).

The literature on Turkey in this field is particularly valuable for our study. It can be noticed that most studies interest on either the more macro determinants as income, GDP, interest rate, loan rate, exchange rate and money supply (Badurlar, 2008; Bekmez and Özpolat, 2013; Lebe and Akbaş, 2014; Öztürk and Fitöz, 2009; Sarı et al., 2007) or micro determinants as number of room, bathroom, size, age of building, type of building, scenery, distance to public facilities and heating system etc. (Caglayan and Arıkan 2011; Keskin 2008; Selim 2009; Kördiş et al., 2014; Mutluer 2008; Yankaya and Çelik 2005). These studies, however, generally focus on country or city-level analysis.

1.1. Problem Definition

A number of studies have been conducted around the world in order to examine determinants of the housing price appreciation. However, this empirical literature has several shortcomings. Firstly, in terms of macro-economic determinants, some of them are considered national variables of different countries, (Adams and Füss, 2010; Beltratti and Morana, 2010; Hirata et al., 2012), while some studies concentrate on the different cities or metropolitan regions (Capozza et al., 2002; Jud and Winkler, 2002; Otto, 2007; Wang et al., 2011). Notwithstanding, these researches largely embrace on only the fundamental determinants.

From another side, some theorists evaluate both fundamental and speculative reasons of the housing price appreciation to explore whether house prices are formed by bubbles or fundamental factors; but, there is no research (to the best of our knowledge) on measuring the relative impact of speculation and fundamental determinants in percentages. Also, the speculation factor is defined by only backward-looking expectations in the analysis (Dipasquale and Wheaton, 1994; Mallick and Mahalik, 2015; Reichert, 1990).

Furthermore, existing studies largely concentrate on the demographic and economic determinants in the context of regional housing price appreciation (Abelson et al., 2005; Abraham and Hendershott, 1994; Apergis and Rezitis, 2010; Badurlar, 2008; Baffoe Bonnie, 1998; Capozza et al., 2002; Gök and Keçeli, 2015; Hepşen and Vatansever, 2011; Jud and Winkler, 2002; Wang et al., 2011). Apart from these, some other studies find out different variables as seasonality, urbanization rate, ethnic mix, accessibility and topographical constraints which have also influences on housing prices (Archer et al., 1996; Koramaz and Dökmeci, 2012; Malpezzi et al., 1998; Reichert, 1990; Topçu and Kubat, 2009). However, these are mainly neighbor-based or city-based studies, thus; still there is inadequacy about cross-regional determinants.

Considering the empirical literature on regional housing prices in Turkey, there are a few attentions on this subject, and also none of them to our knowledge examine both fundamental and speculative determinants.

1.2. Aim of Study and Contribution to the Literature

The first aim of the study is to understand the role of the speculative and fundamental factors on housing prices in Turkey. Both demand-side and supply-side determinants are considered. In order to constitute more detailed research on speculation factor, both backward-looking and forward-looking expectations are used to measure the impacts of speculation. The roles of speculative and fundamental determinants are calculated in percentages which have not calculated before in the literature.

The second aim of the present research is to investigate the reasons of why some regions experiences great price appreciation compared to the other regions. In relation to this perspective, the literature mostly focuses on the economic and demographic variables such as population, income, age distribution etc. This research proposes to incorporate these variables with geographic, climatic, cultural and urbanization variables to pursue more detailed analysis.

To be able to accomplish these analyses, NUTS-2 (Nomenclature of territorial units for statistics) level Turkish regions are analyzed for the period between 2010:1 and 2016:9. Data used in this paper is obtained from TURKSTAT (Turkish Statistical Institute), CBRT (Central Bank of The Republic of Turkey), Ministry of Culture and Tourism, Republic of Turkey, Prime Ministry Disaster and Emergency Management Presidency, Meteorological Service, Republic of Turkey and own calculations (for shore length).

As a consequence, several research questions are addressed,

i) What are the relative (%) effects of fundamental and speculative determinants on regional housing price appreciation in Turkey?

ii) What are the reasons behind the cross-regional variation of housing price appreciation?

iii) How are housing prices influenced by the economic, demographic, geographic, climatic, cultural and urbanization variables?

iv) How do control variables such as population, employment, land availability and inflation shape housing price appreciation process?

1.3. Methodology

This research have 4 methodologies, (1) descriptive statistics to evaluate housing price appreciation of 26 regions of Turkey between the period of 2010-2016, (2) time series (PVAR) analysis to examine the role of fundamental and speculative determinants of housing price appreciation, (3) cross-sectional panel regression analysis to investigate the dynamics behind the cross-regional differences in housing prices, (4) robustness tests to control the results.

Initially, descriptive statistics are calculated for the period of 2010 and 2016; also, Kernel Probability Distribution Functions and Jarque Bera Test statistics are used to verify the geographical distribution of appreciation.

In the second part of the analyses, firstly, a Unit Root Analysis is used by applying an Augmented Dickey Fuller Test to understand the time series properties of variables. Next, the impacts of fundamental and speculative determinants are estimated with a Panel Vector Auto-Regression Model. In this analysis, monthly data is used to for the period of 2011:1 and 2016:9. Cholesky Forecast Error Variance Decompositions and Impulse-Response Functions are used for measuring the movements of housing prices in terms of different variables. At the last part of the these analyses, Forecast Error Variance Decomposition takes advantage of confirming the effects of speculation and fundamental determinants on housing prices in general.

In addition to macroeconomic determinants, the fourth methodology focuses on analyses on regional determinants by using annual data for the period between 2010 and 2015. A Fixed Effect Panel Regressions are implemented by using a Least Squares Dummy Variable (LSDV) Method to avoid the simultaneity problems. Also, a Jarque-Bera Test is calculated to test the normality of errors.

As a last method, in order to verify the robustness of the results, Lagrange Multiplier Spatial Dependence Tests and Granger Causality Tests are implemented. At first, Granger Causality Tests provide information to realize whether the causality is the uni-directed or reversed. For the second, Lagrange Multiplier Spatial Dependence Tests are used to check the possibility of spatial dependence in panel regression.

1.4. Structure of Study

This thesis consists of 6 chapters. The following chapter (2) deals with the theoretical framework behind the issues of housing prices. The impacts of demand and supply in relation to external factors are debated on this part.

The third chapter explains the importance of housing price appreciation and housing sector in Turkish economy. The process of housing price appreciation is shown with the help of graphs and figures. In addition to this, the comparison of housing price appreciation in Turkey with the OECD Countries and Euro Area is demonstrated. Moreover, to highlight the significance of housing sector, total share of housing sector in GDP (Gross Domestic Product) and employment rate and the distribution of house or rent expenditures in household consumption in Turkey are shown in graphs.

The fourth chapter includes literature review. The investigated determinants are established by dividing into 2 main groups as fundamental and speculative variables. In detail, fundamental determinants are tackled in both supply-side and demand-side variables separately. Apart from these, the last sub-part displays the empirical literature on Turkey and other countries with extensive tables.

The fifth chapter includes empirical analyses. At first, housing increasing rates are tried to explain by descriptive and exploratory analyses. In the following 2 sub-parts include the analyses of the impacts of macroeconomic and cross-regional determinants of regional housing prices. The last sub-part involves robustness of results to check the validity.

The final chapter is reserved for summarizing briefly the research outcomes and policy implications. In this chapter, the impacts of significant determinants are discussed with regarding to housing price appreciation. This part also involves recommendations associated with avoiding from the artificial housing price bubble.

1.5. Assumptions and Limitations of Study

The first limitation of the study is about the measuring speculative factors. Although, both backward and forward-looking expectations are taken into consideration in this research, they are still at the national level. Large urban scale developments, branded projects, skyscraper, highway and bridge projects and the most importantly

urban renovation projects have impacts on the property values in local level. However, it needs more detailed local information about these projects and also these are hard to access.

Another limitation is about collecting data for regional determinants. Even if, we intend to measure the effects of light rail system projects, foreign investments on housing, external migration from the other countries; we were not able to reach these data for the period of 2010-2015 in the level of regions.

To the extent that, the first assumption about measuring the risks of geopolitics and internal politic decisions of Turkey. These are considered with the dummies of time in order to digitize them.

The second assumption is related to calculation of the inverse land supply (land availability) determinant. This variable is calculated by dividing the total area of conservation zones in the region (km square) to total area of the region (km square) as a time invariant variable. Because, development areas could be investigated in each region individually, it needs more time and local intuitional attention.

We think these limitations and assumptions can be improved in further researches by dealing more local studies.

CHAPTER 2

THEORETICAL FRAMEWORK

According to the conventional economic theory, housing market basically follows the principles of demand and supply. This theoretical framework is necessary in order to provide basic analytical tools for conceptualization of housing market which is the purpose of the current chapter.

2.1. Housing Demand

Housing demand is conceptualized in the conventional economic theory as the number of units demanded change in response to different prices. Hence, quantity of demanded is triggered by the price changes. In other words; when price increase, the quantity of demanded decreases; which is known as fundamental law of demand.

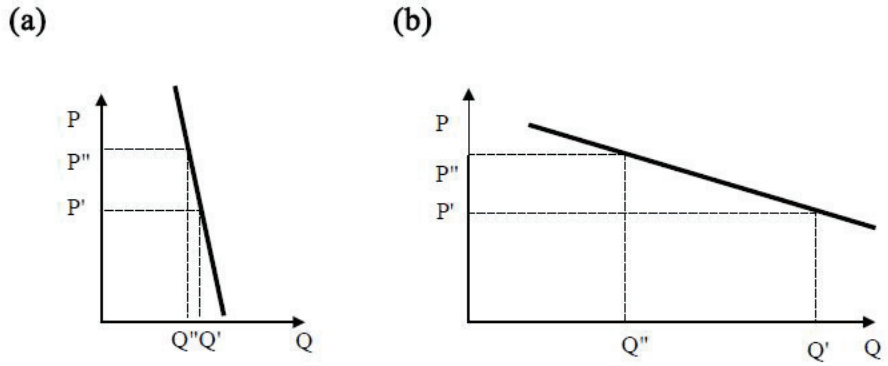

Figure 2.1. Fundamental Law of Demand
(Source: Mourouzi-Sivitanidou, 2011)

However, demand is not only affected by the endogenous factors as prices, it is also influenced by exogenous factors such as market size (population, employment), income/wealth, prices of substitutes and expectations etc. Any changes in exogenous factors can induce shifts of the demand curve (Mourouzi-Sivitanidou, 2011). For

instance, assuming that there is a large immigration to the particular area, which would lead to population growth, keeping prices constant, it can be associated with increases the demand on the number of housing units.

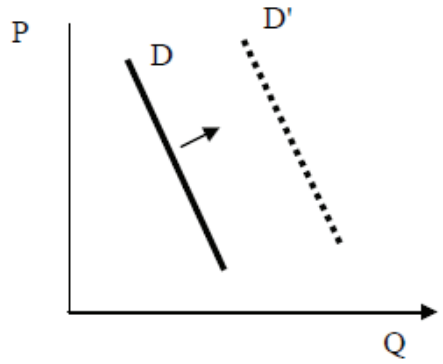

Figure 2.2. Shifts in Demand
(Source: Mourouzi-Sivitanidou, 2011)

2.1.1. Price Elasticity of Demand

Price elasticity of demand is related to the responsivity of demand due to the changes in prices and it is mathematically represented as ε_D. It can be measured by dividing the quantity of demanded to the percentage change in prices. Thus, it demonstrates that how much percentage change in demand emerges by the 1% increase in price (Mourouzi-Sivitanidou, 2011).

$$\varepsilon D = \frac{\Delta P/Q\ [\text{percentage change in quantity demanded}]}{\Delta P/P[\text{percentage change in price}]} \qquad (2.1)$$

$|\ \varepsilon D\ | > 1$ [demand is price elastic]

$|\ \varepsilon D\ | = 1$ [demand is unit elastic]

$|\ \varepsilon D\ | < 1$ [demand is price inelastic]

In general, if demand elasticity is under the value of 1, demand is price inelastic, if it is equal to one, it is unit elastic, and if it is above the value of 1, it is price

elastic. Also, it depends on availability of substitutes. In other words, when demand is inelastic, it will be insensitive to changes of prices. Although there are major decreases in prices, demand give responses as only a small increase (Figure 2.1 (a)) (Mourouzi-Sivitanidou, 2011).

On the other hand, if housing demand is elastic, a small increase in price can results in the major decreases in demand or a small decrease in price causes excess demand on housing. Figure 2.1 (b) indicates the changes of housing prices and quantity of demand due to the elastic demand (Mourouzi-Sivitanidou, 2011).

2.2. Housing Supply

Housing supply, on the other hand, is conceptualized in the conventional economic theory as a function of price. According to the law of supply, while housing prices are increasing, the quantity of supplied housing units increases dependently (Mourouzi-Sivitanidou, 2011).

In addition to the law of supply, the concepts of supply are tackled into 3 aspects as (1) the long-run aggregate supply, (2) the short-run aggregate supply, and (3) new construction (Mourouzi-Sivitanidou, 2011).

2.2.1. The Long-Run Aggregate Supply

The long-run aggregate supply is based on the changes in long-run prices corresponding with the total number of supplied units in the long-run. Considering the Figure 2.3, it can be inferred that the supplied units tend to increase with the long-run prices (Mourouzi-Sivitanidou, 2011).

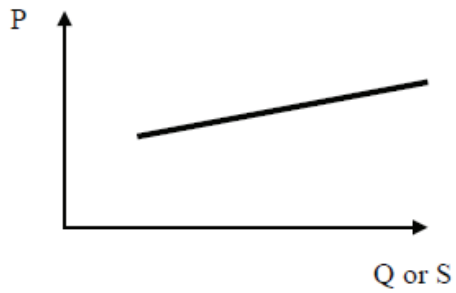

Figure 2.3. The Long-Run Aggregate Supply
(Source: Mourouzi-Sivitanidou, 2011)

2.2.2. The Short -Run Aggregate Supply

The short-run aggregate housing supply is rather fixed. Because of the need for a construction lag, even if prices increase, the number of supplied units remains constant (Mourouzi-Sivitanidou, 2011). In other words, production of housing takes time which makes short-run supply as a constant term. Therefore, it is inelastic in short-run in terms of price. Figure 2.4 displays the relation between the quantity of supplied units and price changes.

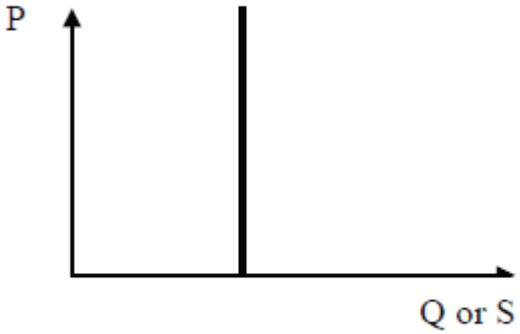

Figure 2.4. The Short -Run Aggregate Supply
(Source: Mourouzi-Sivitanidou, 2011)

2.2.3. New Construction

According to fundamental law of supply, new construction is triggered by higher prices. However, this price should be above the *Pmin* (Figure 2.5) which refers to the minimum price threshold in order to afford the cost of the development and have a feasible profit.

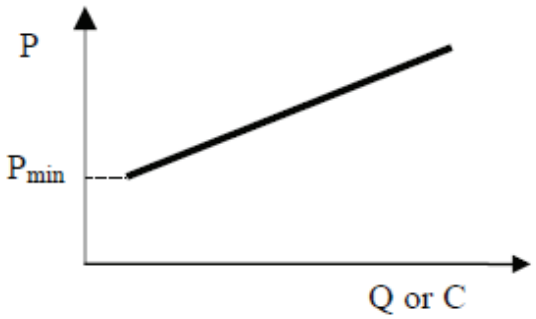

Figure 2.5. New Construction
(Source: Mourouzi-Sivitanidou, 2011)

Along with the prices, the quantity of supply influences from the exogenous factors as expectations, labor, capital, building materials which can result in the shifts on new constructions. For instance, any increase in the cost of labor or building materials can cause the downward shifts of the new construction schedule or vice versa. As a consequence, these exogenous determinants specify the new construction as well (Figure 2.6) (Mourouzi-Sivitanidou, 2011).

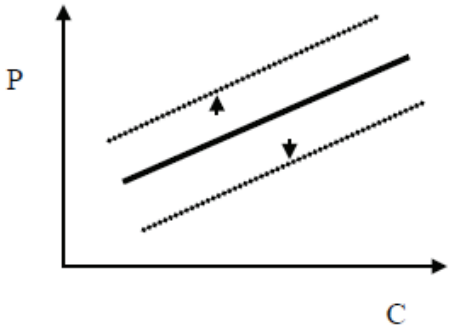

Figure 2.6. Effects of Exogenous Shifters on New Construction
(Source: Mourouzi-Sivitanidou, 2011)

2.3. Price Determination Mechanism

In the context of the price determination mechanism, housing prices are determined by the interactive relation of supply and demand. The intersection point demonstrates the equilibrium price at which the number of buyers equals the number of sellers, thus, it at which QD= QS.

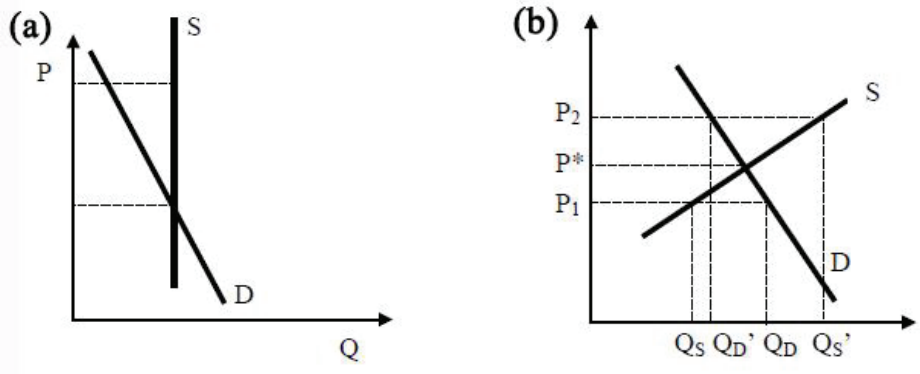

Figure 2.7. Price Determination Mechanisms
(Source: Mourouzi-Sivitanidou, 2011)

Figure 2.7 represents the equilibrium price level P* which is at the intersection of the quantity of demand and supply. To illustrate, in short-run

mechanism, while prices are increasing, demand becomes decrease; but, the quantity of supply is constant because of the needs of construction time (Figure 2.7 (a)).

On the contrary to this mechanism, the long-run mechanism has different consequences. For example, when the price level is at the P1, quantity of demand QD, is higher than the quantity of supply QS. At this point, prices will increase due to an excess demand until reaching the P* level of price. In this case, while some sellers will be out of the housing market because of the existing lower price, some other sellers are motivated by increasing prices (Figure 2.7 (b)).

On the contrary, when the price level is at the P2, supplied units are more than demanded units. In this stance, buyers are not disposed to pay high prices to the properties, to cope with the lower demand, sellers will reduce the prices to enhance housing sales until reaching at the level of the P* (Figure 2.7 (b)) (Mourouzi-Sivitanidou, 2011).

CHAPTER 3

HOUSING SECTOR IN TURKEY

To provide background information on the housing price appreciation in Turkey, it is necessary to compare with other countries' price appreciations. Hence, Real House Price Index of Turkey is shown below with the corresponding evolutions in OECD countries and Euro Area for the period between 2010:Q1-2016:Q4 (Figure 3.1). According to Figure 3.1, while the Housing Price Indices decline for Euro Area and increase very slightly for OECD countries, these raise quite rapidly in Turkey (OECD Analytical House Price Database, 2017). As a consequence of this difference, housing price appreciation is understood as a substantial subject for Turkey and needs more attention in empirical literature.

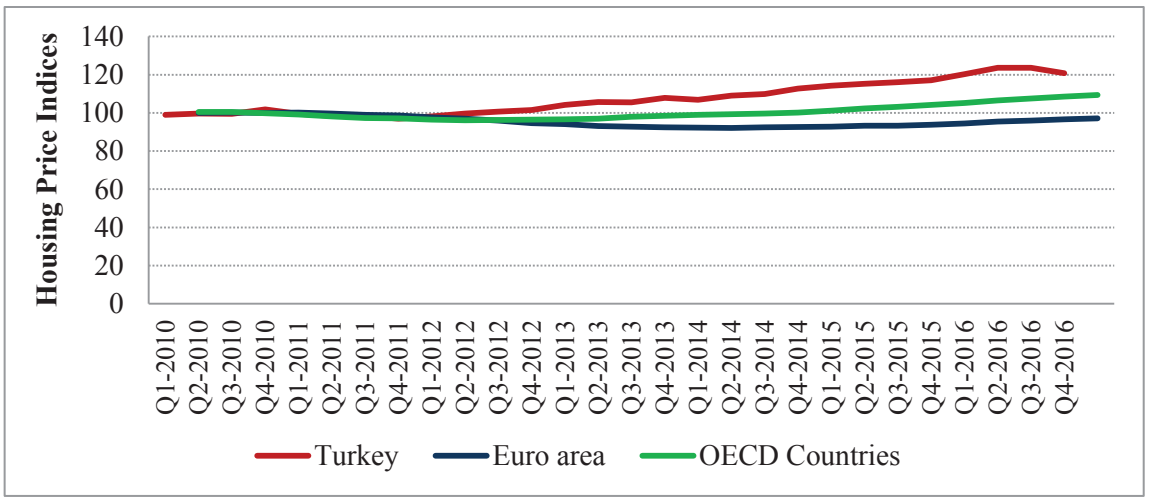

Figure 3.1. Real House Price Index of OECD Countries, Turkey and Euro Area, 2010:Q1-2016:Q4 (Source: OECD Analytical House Price Database, 2017)

In addition to comparing housing price appreciation with other countries, we consider the total share of housing sector (construction and all other real estate service activities) in GDP (Gross Domestic Product) for the period of 1998 to 2015 (Figure 3.2).

In relation to this, Figure 3.2 demonstrates precisely that the share of construction sector tends to rise in recent years. While it is only 12 % in 1998, it reaches to 18 % in 2015. Therefore, we can argue that roughly about 1/5 of the economic activities in Turkey are related to the real estate market.

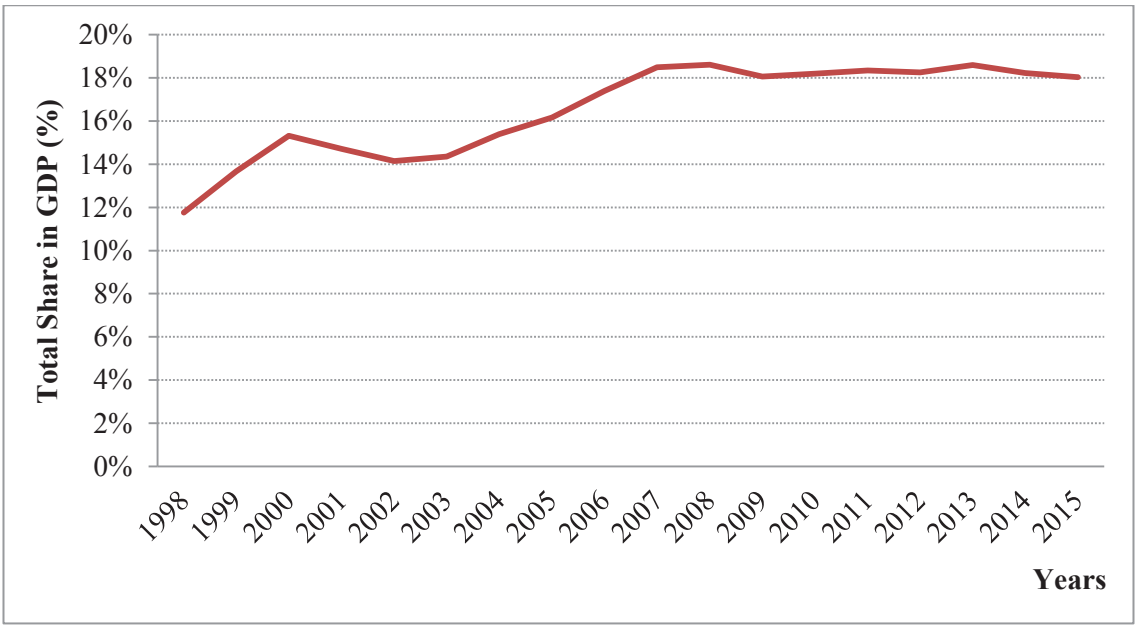

Figure 3.2. Total Share of Housing Sector in GDP, 1998-2015
(Source: TURKSTAT, 2016)

In order to constitute better understanding for the importance of real estate sector, we focus on 2 more aspects: (1) share of real estate sector in employment.[1] (2) share of housing or rent expenditures of households in total expenditure.

At a glance, Figure 3.3 illustrates employment share of construction for the period 2005 to 2016. Correspondingly, there is an ascending rise in employment share in construction. Such that while the employment share is 5.5% in 2005, it rises up to about 7.2% in 2010 and, after this period, it ranges between 7.2% and 7.4%.

[1] Real estate sector is composed of construction activities and real estate services.

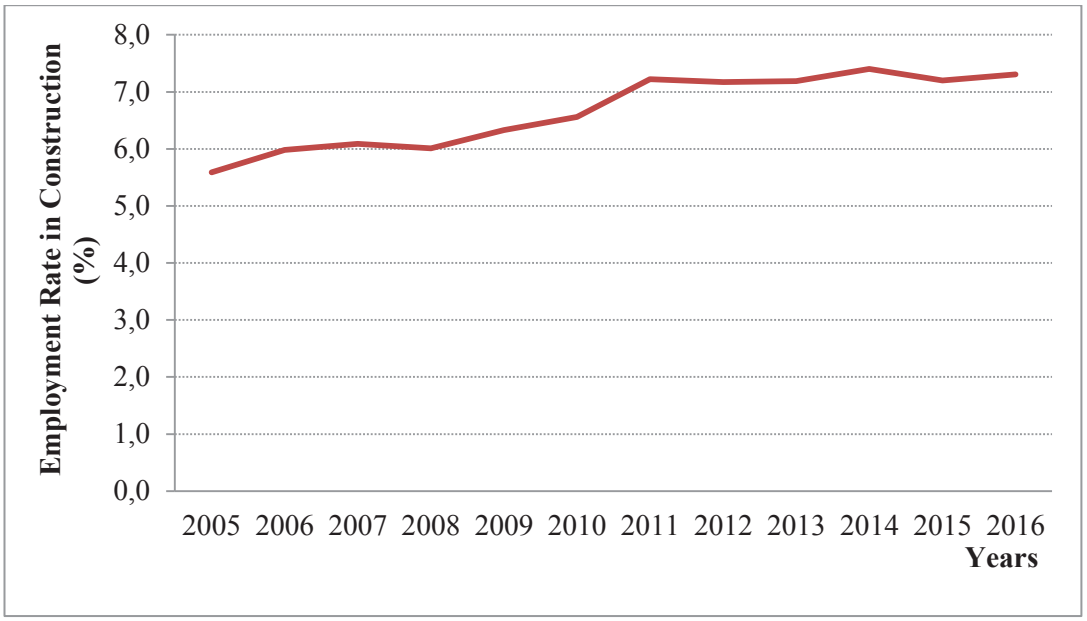

Figure 3.3. Employment Rate of Construction, 2005-2016
(Source: TURKSTAT, 2016)

Secondly, Figure 3.4 reveals the distribution of house or rent expenditures in household consumption in their total expenditure. It seems that while housing/rent expenditures are about 28% in 2003, it becomes 26% in 2015, hence, it represents almost 1/4 of total expenditures which as an important constituent of household consumption.

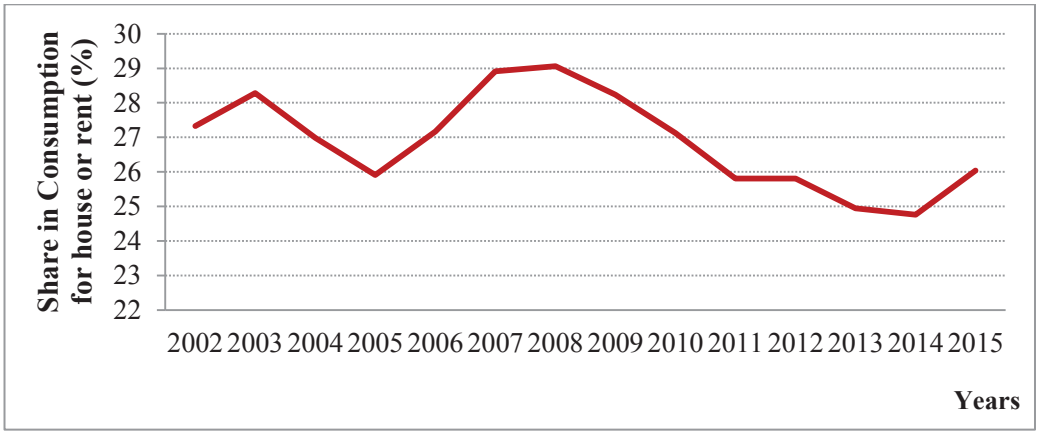

Figure 3.4. Share of House or Rent Expenditures in Household Consumption, 2002-2015 (Source: TURKSTAT, 2016)

CHAPTER 4

HOUSING DETERMINANTS IN THE LITERATURE

The subject of determinants of regional housing prices has been studied since 1940s in the literature. Most of the studies have intended to investigate why some regions in a country experience faster increase in housing prices. Mainly, the determinants of housing prices are discussed in 2 main groups such as fundamental and speculative determinants (Himmelberg et al., 2005; Mallick and Mahalik, 2015).

To the extent that fundamental determinants are associated with the changes on 2 main variables as demand-side and supply-side variables. Figure 4.1 introduces the main categories of the housing price determinants.

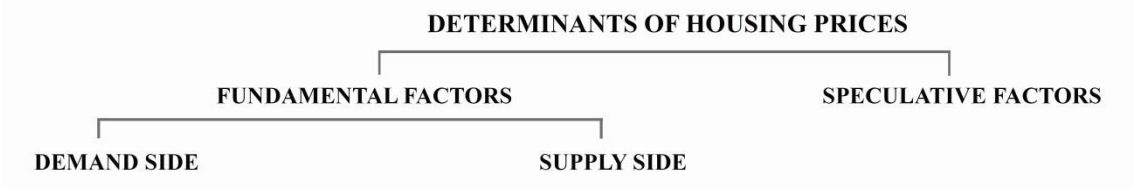

Figure 4.1. Main Categories of Housing Price Determinants

Among them, housing demand is influenced from both aggregate variables as changes in mortgage interest rates, credit availability, money supply and region specific variables as income level of regions, wealth, employment growth, inflation, population, city size, net migration, household size, life expectancy, urbanization rate and trade openness of regions (Abraham and Hendershott, 1994; Apergis and Rezitis, 2003; Baffoe Bonnie, 1998; Blumenfeld, 1944; Eaton and Eckstein, 1997; Goetzmann and Volaitis, 2006; Hausman and Wise, 1980; Kearl, 1979; Lee, 1963; Mallick and Mahalik, 2015; Mankiw and Weil, 1989; Öztürk and Fitöz, 2009; Poterba, 1991; Smith and Tesarek, 1991; Wang et al., 2011).

On the other hand, housing supply is mostly influenced from the changes in interest rate, construction cost, regional inflation rate, land availability, credit volume

and financial return of alternative investment options (gold, stock prices etc.) (Chan, 1999; Dipasquale, 1999; Poterba, 1991; Topel and Rosen, 1988).

In addition to fundamental factors, it has been argued that housing prices can also increase due to speculative reasons, such as bubbles (Case and Schiller, 1988). For instance, once housing prices start increasing in a region, it causes further appreciation in that area. This herding behavior occurs because individuals prefer more buying the properties in these regions since they expect a higher value increase in future (Capozza et al., 2002; Levin and Wright, 1997; Mallick and Mahalik, 2015). This behavior is termed backward-looking expectation as individuals decide buying the properties by analyzing the former changes in housing prices (Capozza and Sequin, 1996; Capozza et al., 2002).

4.1. Fundamental Determinants

Researches have different views on the type of fundamental housing determinants. Although most of the previous studies put forward macroeconomic determinants at national level or microeconomic factors or region specific variables, there are not yet a clear set of variables. To illustrate, Oikarinen (2009) suggests regional variables because he claims that housing prices are local in nature and these are the main drivers of housing prices. In relation to this, Hekman (1985) declares that if macro determinants represent micro determinants in the same way, it can be appropriate to implement them instead of regional determinants. At this juncture, he emphasizes the difficulty of collecting regional data (Mallick and Mahalik, 2015). Moreover, McAvinchey and Maclennan (1982), Manchester (1987) and Singell and Lillydahl (1990) highlight the importance of regional data. Besides, Krumm (1987) finds out that regional differences attract housing demand in specific regions (Reichert, 1990). On the contrary, Karakozava (2004) argues that national macro determinants are more rational because they have impacts on micro and regional variables; however, at the same time, he refers also the importance of region-specific determinants for getting depth insights (Mallick and Mahalik, 2015).

As a consequence, this chapter reviews the literature on potential determinants of regional housing prices.

4.1.1. Demand-Side Variables

4.1.1.1. Mortgage Interest Rate (Aggregate Variable)

Housing demand is directly related to mortgage interest rate at the time as most people tend to buy a property with a housing credit. Thereby, when mortgage interest rate decreases, the cost of financing the housing decreases as well; hence, demand will increases or vice versa (Baffoe Bonnie, 1998; Öztürk and Fitöz, 2009). From this perspective, the claim is that the relationship between mortgage interest rate and real estate demand is inversed. Furthermore, high interest rate increases the return of risk-free investment. That's why; in that case, investors prefer other investment assets such as bonds or bank deposits rather than real estate (Durkaya, 2002).

On empirical grounds, a wide range of studies confirm this inverse relationship in different grounds (Abelson et al., 2005; Adams and Füss, 2010; Apergis and Rezitis, 2010; Baffoe Bonnie, 1998; Capozza et al., 2002; Köse et al., 2012; Otto, 2007; Reichert, 1990). For instance, Baffoe Bonnie (1998) who focuses on 4 big regions in US between the periods of 1973-1994 and Apergis and Rezitis (2010) who analyze Greek housing market for a period of 1981-1999 by using mainly time series techniques (such as VAR, Impulse-Responses and Co-Integration Analysis), are some of the examples. In detail, their results demonstrate that change in mortgage interest rate accounts for about 35-40% of the changes in housing prices which represents a quite important impact.

4.1.1.2. Money Supply and Credit Availability (Aggregate Variable)

Money supply and credit availability are among the other important demand side variables. Baffoe Bonnie (1998) claims that a sudden decrease in money supply results in excess demand for credit in associated with the need of money. Thus, this situation rises up the interest rates and people intend to delay their expenditures, including housing investments. As a consequence, it causes reduction in housing prices. If the opposite is considered, he mentions that when money supply is raised by the Central Bank, an excess supply occurs in money market which causes interest rates to

decline (Baffoe Bonnie, 1998). Therefore, the cost of financing the real estate lowers. Hence, the demand for properties and their prices tend to increase.

This statement is studied by many researches and most of them support that money supply is unlikely an important variable; but, it moves generally in the same direction with housing prices (Beltratti and Morana, 2010; Lastrapes, 2002; Öztürk and Fitöz, 2009; Sarı et al., 2007). For instance, Baffoe Bonnie (1998) finds, for instance, that only 2-18% of the changes in U.S. housing prices are due to changes in money supply. A similar finding is reported by Apergis and Rezitis (2010) that in Greek housing market only a small fraction of housing prices changes is attributed to money supply. Consistent with these studies, Öztürk and Fitöz (2009) find positive effect of money supply on housing demand. However, Badurlar (2008) who analyze the dynamic effects of macroeconomic determinants on house prices in Turkey for the period 1990-2006, finds out that they have negative relations.

In addition to money supply, credit availability have also significant role on housing prices implicitly (Egert and Mihaljek, 2007; Hepşen and Kalfa, 2009; Panagiotidis and Printzis, 2015). The claim here is, when credit availability increases, interest rates fall down, as a result, demand for housing increases. So, the relations of credit availability and housing prices have found in the same direction.

4.1.1.3. Income and Economic Variables (Region-Specific Variable)

In the empirical literature, income level of regions is found as a major factor that raises the housing demand and prices. The claim is that the rising income levels boost housing affordability, regarding this, real estate prices tend to increase by the virtue of an additional demand of properties (Hausman and Wise, 1980; Hendershott and Thibodau, 1990; Ozanne and Thibodau, 1983). In relation, Mallick and Mahalik (2015) assert that income growth results in the structural changes especially in emerging economies. So that housing demand increases in these areas for an alternative asset to live or to expected future returns.

Moreover, higher incomes attract housing demand by means of an increase in the rate of marriages which promotes the necessity of sheltering as well (Blumenfeld, 1944; Kartman, 1972; Li and Chand, 2013).

Correspondingly, the impact of income is measured in a number of studies and the majority of them have found positive and significant effect (Abelson et al., 2005; Abraham and Hendershott, 1994; Bekmez and Özpolat, 2013; Capozza et al., 2002; Jud and Winkler, 2002; Lebe and Akbaş, 2014; Malpezzi et al., 1998; Öztürk and Fitöz, 2009; Paz, 2000; Reichert, 1990; Wang et al., 2011).

For instance, La Paz (2000) who analyzes this issue for 71 Spanish provinces between 1987-1999 , Wang, Yang and Liu (2011) for 35 Chinese cities between 1998-2006 and, additionally, Jud and Winkler (2002) for 130 Metropolitan Statistical Areas (MSA) in U.S. between 1984-1998, find positive and significant impact of income on housing prices. In contrast, Mallick and Mahalik (2015) find insignificant effect in their analysis on Indian cities for a period 2010-2013.

In addition to level of income, some studies concern with employment growth, unemployment, labor participation rate and other critical variables. They assert that increasing employment rate or employment growth will enhance to housing affordability by the help of regular income (Hyclak and Johnes, 1999; Smith and Tesarek, 1991; Sternlieb and Hughes, 1977). Hence, it results in more demand for housing.

4.1.1.4. Regional Inflation Rate (Region-Specific Variable)

The impact of inflation is debatable in the literature. While some researchers claim that inflation has a decreasing effect on house prices (Abelson et al., 2005; Feldstein, 1992; Kearl, 1979; Lebe and Akbaş, 2014; Mallick and Mahalik, 2015), according to the other's claims, it may promote housing price appreciation (Apergis and Rezitis, 2010; Baffoe Bonnie, 1998; Bekmez and Özpolat, 2013; Otto, 2007).

The first claim depends on the idea that if expected inflation is high, the mortgage rate increases in the money market, notwithstanding, demand for property decreases (Baffoe Bonnie, 1998; Kearl, 1979). Furthermore, inflation reduces the purchasing power of individuals which decreases households' incentives to buy properties (Kartman, 1972; Öztürk and Fitöz, 2009). Under high inflation, nominal mortgage payments become more expensive which prevents households from buying additional properties (Kearl, 1979). With reference to this, Summers (1980) measures

the impact of expected permanent inflation on housing prices. He reveals that it is the main driver behind the accelerating housing prices.

The second claim, on the contrary, is that when the inflation rates increase, people prefer to invest on real estate as a safe investment tool to be avoiding from the depreciative effects of inflation. Thus, this idea causes a rise in demand for properties (Goetzmann and Valaitis, 2006; Öztürk and Fitöz, 2009).

Empirically, there are mixed results in the literature. Mallick and Mahalik (2015) find negative relation between inflation and housing prices in India. In contrast, Apergis and Rezitis (2010) measure short and long run effects of macroeconomic variables in Greece and find out that a sudden increase in inflation stimulates housing prices in the first quarter and eventually, may reduce housing demand afterwards. In a similar manner, Öztürk and Fitöz (2009) reach positive relation with inflation although they expected inverse, as a supporting evidence for the second argument.

4.1.1.5. Demographic Variables (Region-Specific Variable)

Demographic characteristics of the regions are defined as critical factors by having a significant impact on housing demand and prices. These factors are examined as population, density, household size, age average of the region and education level etc. in the empirical literature (Archer et al., 1996; Capozza et al., 2002; Goodman, 1990; Jaffee and Rosen, 1979; Jud and Winkler, 2002; Keskin, 2008; Mamre, 2014; Mikhed and Zemcik, 2009; Reichert, 1990; Weicher and Thibodeau, 1988). Among them population and population density are one of the most crucial determinants. Herein, the claim is that increasing population in a certain area, keeping housing stock constant, contributes to rise in housing demand. In depth, for example in highly populated metropolitan cities housing demand and prices grow faster as there is a good quality of life, diverse set of consumption goods, well established infrastructure and facilities (Eaton and Eckstein, 1997; Ermisch, 1990; Lee, 1963; Mankiw and Weil, 1989; Paz, 2000).

On the other hand, age average of the region is an important variable for housing price appreciation. Younger age profile, for instance, has more propensities to demand housing for both consumption and investment purposes (Galati et al., 2011).

Also Lee (1963) remarks average age of the region because getting credit has different constraints as age threshold.

Moreover, small household size, marriage rates and life expectancy are the other important determinants that indicate the extent to which individuals need housing (Li and Chand, 2013; Martin, 1966).

Additionally, quality of education, education level (bachelor rate) and density of students in the region are the variables related to human capital. The increase in the level and quality of education is likely to make the region more attractive for housing and, thus, the prices should increase faster (Eaton and Eckstein, 1997).

4.1.1.6. Immigration and Urbanization (Region-Specific Variable)

This group of variable is less emphasized in the literature. Among others, net immigration, accessibility and urbanization rate are also substantial variables which are considered to induce housing demand (Durkaya, 2002; Gök and Keçeli, 2015; Mamre, 2014; Martin, 1966; Öztürk and Fitöz, 2009; Yankaya and Çelik, 2005; Yayar and Gül, 2014; Yayar and Karaca, 2014). To the extent that, Öztürk and Fitöz (2009) assume that immigration leads to a rise in the need of sheltering, therefore, urbanization rate are accelerated to rise, in connection with these, housing prices increases. In relation, Gök and Keçeli (2015) support this perspective by extrapolating favorable impacts of immigration on housing prices. Moreover, accessibility is also one of the important variables for housing prices. However, this is only examined in small scale studies by measuring distance to center, public transportation, main roads and sea etc. (Kördiş et al., 2014; Topçu and Kubat, 2009; Yankaya and Çelik 2005; Yayar and Gül, 2014; Yayar and Karaca, 2014).

4.1.1.7. Economic Openness (Region-Specific Variable)

Trade and financial openness of the cities are argued to promote the housing demand and prices. This proposition is discussed in detail by Wang and Liu (2011) and they emphasize two main channels through which openness can affect the housing prices. The first one is the quality of life channel according to which “open” cities have

greater amenities in consumption and product diversity; hence, a good quality of life (Roback, 1982). Thus, the demand for properties is higher in these places. The second one is called Balassa (1964) and Samuelson (1964) effect. The rationale behind this effect is that trade openness brings higher productivity in tradable goods sector that rises the wages in both tradable and non-tradable sectors. Increases in wages imply higher affordability and demand for real estate products. Hence, property prices tend to increase.

In their study on 35 Chinese cities between the years of 1998-2006, Wang and Liu (2011) report a positive and significant impact of trade openness on regional housing prices.

4.1.2. Supply-Side Variables

4.1.2.1. Land Supply (Region-Specific Variable)

The availability of land within the region automatically affects the housing supply (Dipasquale, 1999; Topel and Rosen, 1988). Within the cities which large sites for construction are available, housing supply is expected to be higher. Thus, lower increase in housing price is expected. In other words, the cities which have intensively protected zones are likely to have less housing supply and higher prices.

Empirically, Öztürk and Fitöz (2009) show that the rate of urbanization which might consistently increase the land availability. In parallel with this housing supply enlarges, thus, housing prices fall down.

Besides, Capozza et al. (2002) who deal with 62 Metro Areas in U.S. for the period between 1979 and 1995, demonstrate that when an excessive land supply occurs in a particular area, it decreases housing prices because demand will be smaller than the over-endowed properties.

4.1.2.2. Construction Costs and Inflation (Region-Specific Variable)

Construction cost is frequently cited supply-side variable which is considered to have an inductive effect on housing prices (Abraham and Hendershott, 1994; Adams

and Füss, 2010; Chan, 1999; Jud and Winkler, 2002; Potepan, 1996; Poterba, 1991; Reichert, 1990). The claim is that ascending construction costs such as the price of raw materials and labor lead to an increase in the financing costs of construction and change the supply schedule, especially for new construction (Adams and Füss, 2010). At this stage, this sector is more costly and less profitable to invest (Potepan, 1996). Hence, housing supply tends to reduce which causes prices to increase (Chan, 1999).

In addition, Jud and Winkler (2002), who study on 130 MSAs in U.S. between the years of 1984-1998, find that there is a strong relation between housing price appreciation and construction costs. Abraham and Hendershott (1994) and Poterba (1991) assert that construction costs are significant factor in determining housing price appreciation. Besides, the relation between construction costs and housing prices are empirically tested and confirmed by Adams and Füss (2010)'s study, which is on 15 countries for the period between 1975 and 2007. They find out that a 1% rise in construction costs causes 1.3% increase in house prices.

On the other hand, inflation is also nuisance variable for examining supply-side determinants of housing price appreciation. Mallick and Mahalik (2015) declare that when inflation rate accelerates in a region, it raises housing prices due to increasing construction costs. However, this rapid price appreciation lowers demand in concert with real estate investments. To the extent that, they bring out that housing prices are adversely influenced from inflation. Likewise, Feldstein (1980) asserts that reduction in inflation causes a rapid rise in new housing construction.

4.1.2.3. Interest Rate (Aggregate Variable)

This variable is mentioned in a wide range of studies and generally they find out that it has negative impacts on housing price appreciation (Badurlar, 2008; Hepşen and Kalfa, 2009; Hirata et al., 2012; Sarı et al., 2007). However, most of them deal with interest rates as a demand-side variable.

Changes in interest rate might play a key role on housing prices through the supply channel. Indeed, high interest rates triggers to the cost of financing the construction projects and mortgage rates, which discourages firms from new construction projects. This lowers the housing supply and increases the property prices (Adams and Füss, 2010; Hirata et al., 2012; Topel and Rosen, 1998). Despite of the

consensus on the negative impacts of interest rates, Adams and Füss (2010) emphasize on the different impacts of short-term and long-term interest rates. They claim that the immediate response of house prices to high short term interest rate might be positive, because of the higher construction costs; but, the long-term interest rates have a negative effect on house prices eventually. Since, an increase in the long-term interest rates might attract to invest other fixed-income assets rather than real estate.

Similarly, money supply and credit availability can be argued as other important supply-side variables. They indicate the fact that, during the periods of tight monetary policy, credit availability falls sharply. This forces small firms to invest less as they can hardly finance their construction projects. Hence, property prices tend to increase (Chan, 1999).

4.2. Speculative Determinants

In recent years, growing strands of researchers emphasize the role of speculative factors in housing markets (Levin and Wright, 1997, Mallick and Mahalik, 2015). Herein, Capozza et al. (2002) assert that people are more interested in investment value of a property rather than consumption purposes. The most important example of this is experienced in 2008-2009 global financial crisis when an unsustainable growth of sub-prime lending and credits create an artificial housing price bubble in U.S. which, in turn, cause a worldwide economic recession (Miles, 2014).

There are various researchers belong to this stream who defends the significant role of speculative decisions on housing markets (Clark and Coggin, 2011). The proponents claim that once housing prices start increasing in an area, this further (cumulatively) appreciates the prices. Individuals intensively prefer buying the properties in these places since they expect a higher increase in values. This behavior relies on backward-looking expectations as people analyses the past values of the properties (Capozza and Sequin, 1996; Case and Schiller, 1988). Mathematically, this behavior can be expressed in a following way,

$$HPI_t = f(HPI_{t-1,} HPI_{t-2}, \ldots . HPI_{t-n}) \quad (4.1)$$

where *HPI* represents the housing prices in a region. According to the expression, housing prices is a function of its past values.

To test this proposition, empirical studies are adopted autoregressive time series regressions. Mallick and Mahalik (2015) find a quite significant speculative component in Indian housing market. A similar finding is also reported by Capozza et al. (2002) and Clark and Coggin (2011) for U.S. market.

On the other hand, some researchers use price-rent ratio in measuring the effect of speculation. To illustrate, Capozza and Seguin (1995) work on price-rent ratios in order to understand its role on housing price appreciation. Comparably, IMF (The International Monetary Fund) declares that housing price appreciation is about 110% in nominal and 35% in real terms in Turkey for the period of 2010:12-2016:07 by concerning price-to-income and price-to-rent ratios (IMF Country Report, 2016).

In short, although speculation variable is quite severe, a very limited attention is paid to this issue as mentioned also in the introduction part.

At last, Figure 4.2 illustrates housing determinants from the empirical literature, including the direction of results.

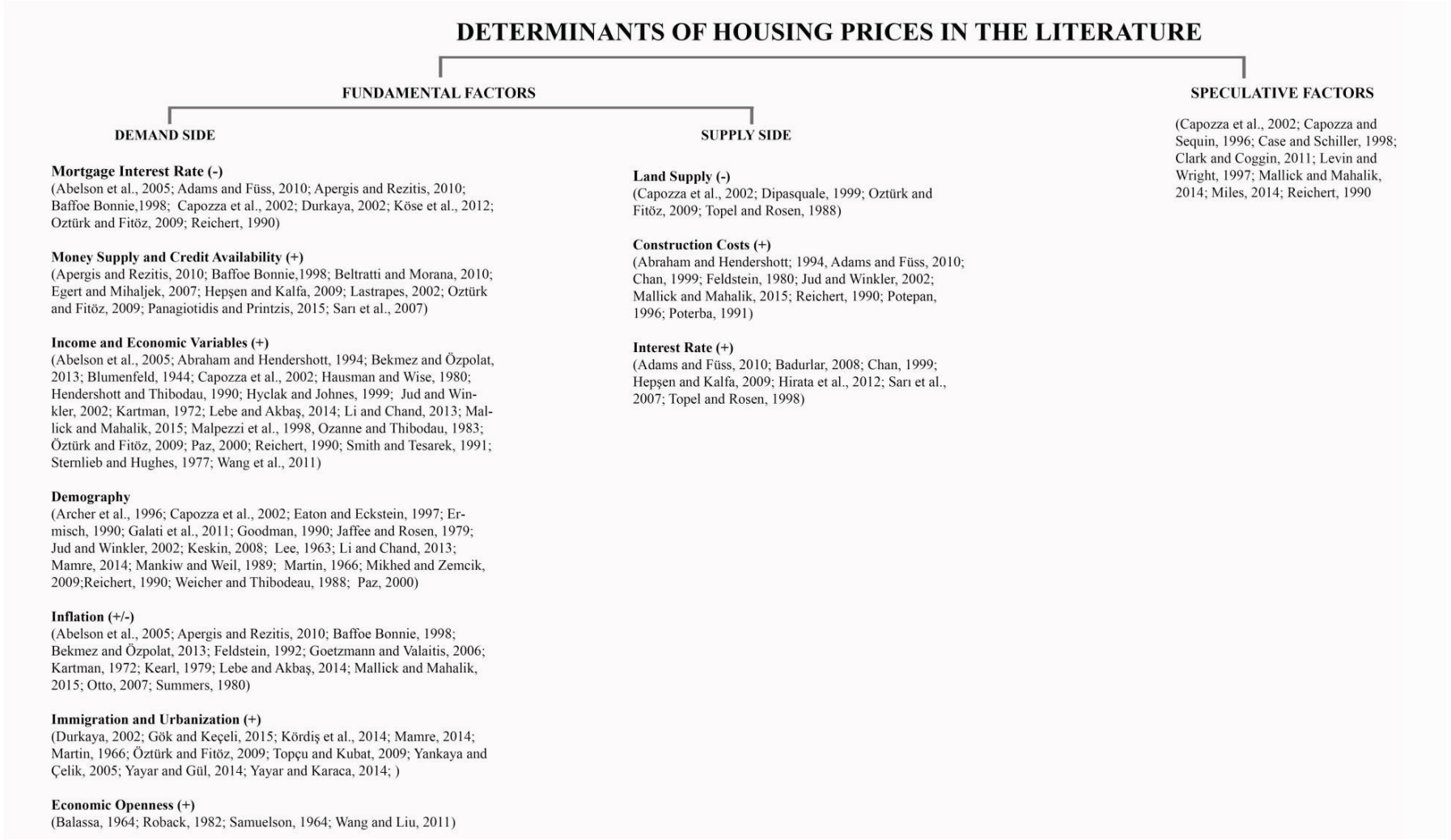

Figure 4.2. Housing Determinants from the Empirical Literature

4.3. Empirical Literature on Turkey

The literature on housing price determinants of Turkey can be classified in 3 groups of studies which use aggregate variables in national level, local variables in city/region level, building specific variables in city/region/district level.

Most of these studies signify macro-determinants as income, GDP (Gross Domestic Product), interest rate, migration, unemployment rate, consumer price index, money supply, exchange rate etc. (Badurlar, 2008; Bekmez and Özpolat, 2013; Hepşen and Kalfa, 2009; Lebe and Akbaş, 2014; Öztürk and Fitöz, 2009; Sarı et al., 2007). However, these studies neglect the role of speculation and also they generally concentrate on only demand side variables. Among these, the study of Öztürk and Fitöz (2009) is dealt the impacts of demand and supply variables separately and find that while income and interest rate affect housing demand positively, GNP (Gross National Product) and income have favorable impacts on housing supply.

There is only a study (to our knowledge) which is interested to 26 development regions of Turkey; but, this study also sets sights to the macro-determinants as GVA (Gross Value Added) per capita and net domestic migration (Gök and Keçeli, 2015).

On the other hand, some studies investigate the effects of local variables as accessibility, housing and neighborhood characteristics, centrality, security and density etc. in order to understand their impacts on housing appreciation; but, these are implemented at the city or district level (Koramaz and Dökmeci, 2012; Topçu and Kubat, 2009; Yankaya and Çelik, 2005).

Besides these, studies elaborate on the building specific variables as number of room, bedroom, bathroom, saloon, lift, heating system, having garden, age, size, having security system, parking area and scenery etc. (Cağlayan and Arıkan, 2011; Keskin, 2008; Kördiş et al., 2014; Mutluer, 2008; Selim, 2009; Yankaya and Çelik, 2005, Yayar and Gül, 2014; Yayar and Karaca, 2014).

In relation to these, Table 4.1 demonstrates an overview for the studies on housing price determinants of Turkey.

Table 4.1. Studies on Turkey

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Öztürk and Fitöz, 2009	Turkey	To determine supply and demand factors of housing market in Turkey	1968-2006	Annual	Regression Analysis, Leasts Squares Method	**Demand** Per Capita Income (+) Interest Rate (+) **Supply** Per Capita Income (+) Money Supply/Gross National Product (+)
Gök and Keçeli, 2015	26 Development Regions of Turkey	To examine the determinants of house prices in Turkey	2014-2015	Annual	OLS and Stepwise Regression Model	GVA Per Capita (+) Net Domestic Migration (+)
Lebe and Akbaş, 2014	Turkey	To emphasis on the long and short term effects of housing demand	1970-2011	Annual	VECM	Income Per Capita (+) Marital Status (+) Industrialization (+) House Prices (-) Inflation (-) Agricultural Employment (-)
Bekmez and Özpolat, 2013	Turkey	Analyzing the relationship between housing demand and its determinants	1986-2009	Annual	Co-Integration Test, Granger Causality Test, VAR Analysis	Income Per Capita (+) Inflation (+) Unemployment Rate (-) Share Market (-)
Badurlar, 2008	Turkey	Analyzing the dynamic effects of macroeconomic determinants on house prices	1990-2006	Quarterly	Johansen Co-Integration Test, VECM, VEC Granger Causality, Block Exogeneity Wald Test	GDP (+) Money Supply (-) Interest Rate (-) Exchange Rate (+)
Koramaz and Dökmeci, 2012	İstanbul	To measure the effect of spatial characteristics on housing prices	May- July 2009	Monthly	A Semi-Hedonic Pricing Model, Spatial Data Analysis Kriging Method	Centrality (-) Accessibility (-) Characteristics (+/-)

(Cont. on next page)

Table 4.1. (Cont.)

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Yankaya and Çelik, 2005	İzmir, Üçyol and Bornova Districts	To investigate a relationship between property values and changes in accessibility caused by transportation infrastructure investment	December 2003-March 2004	Survey	Hedonic Price Model	Distance to the Nearest Station (-) Distance from Nearest Bus Stop (-) House Area/Size (+) Number of Apartments (-) Number of Bedrooms (+) Number of Story (+) Number of Floor (+)
Yayar and Gül, 2014	City Center of Mersin	To investigate the factors of house prices in Mersin	November,2011-Fabruary,2012	Survey	Hedonic Price Model	Usage Area of Flat (+) Kitchen Size (+) Distance to Bazaar (+) Number of Bath (+) Garage (+) Central Satellite System (+) Private Security (+) Number of Elevators (+) Garden (-) Being Housing Estate (-) Distance to the Public Transportation (-) Age (-)
Yayar and Karaca, 2014	TR83 Region	To investigate the factors of house prices in TR83 Region	May-September, 2012	Survey	Hedonic Price Model	Number of Bath (+) Number of Lifts (+) Being on Boulevard (+) Central Heating (+) Being City Center (-) Being First Floor (-) Using Fuel-Oil (-)

(Cont. on next page)

Table 4.1. (Cont.)

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Hepşen and Kalfa, 2009	Turkey	To examine dynamic causal relationships between housing market activity and Macroeconomic Variables	2002- 2007	Annual	Granger Causality Tests, Impulse Response Functions, Variance Decomposition Model	Interest Rate (+) Industrial Production Index (+) Volume of Mortgage Loans (+)
Sarı, Ewing and Aydın, 2007	Turkey	To investigate the relation between housing starts and macroeconomic variables in Turkey	1961-2000	Annual	Unit Root Tests, Multivariate Co-Integration Test	Interest Rates (+) Output (+) Money Stock (+) Employment (+)
Mutluer, 2008	39 Neighborhood of Çankaya, Ankara	To understand relationship between house prices and housing characteristics empirically.	June-July, 2007	Survey	Hedonic Regression Model	Location (+) Number of Room (+) Number of Bathroom (+) Total Storeys Of The Building (+) Floor Number (+) Size (+) Age (-)
Selim, 2009	Turkey	To explore determinants of house prices in Turkey are examined for the urban, rural and whole country	2004	2004 Household Budget Survey	Hedonic Regression Model, Artificial Neural Network (ANN)	Locational Characteristics (+) Type of House (-) Age of Building (-) Type of Building (-) Floor Types (-) Heating System (+) Number of Rooms (+) Size (+)

(Cont. on next page)

Table 4.1. (Cont.)

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Topçu and Kubat, 2009	504 Streets in Istanbul	To discuss urban and spatial factors which affect the urban land values in residential areas	2009	Survey	ANOVA Analysis, Regression Analysis, Space Syntax Method	Accessibility (+) Environmental Features (+) Security (+)
Çağlayan and Arıkan, 2011	İstanbul	To investigate the relationship between house prices and housing characteristics in İstanbul	October–December, 2007	Survey	Hedonic Price Model, Quintile Regression Technique	Age of Houses (+) TV Cable (+) Security (+) Heating System (+) Garage (+) Kitchen Area (+) Number of Rooms and Bathrooms (+)
Kördiş Işık and Mert, 2014,	Antalya	To analyze the factors which affect the house prices in Antalya	2013	Annual	Hedonic Price Model	Size (+) Region in High Level Income (+) Scenery (+) Parking Area (+) Being Flat (+) Distance to Sea (+) Heating System (+) Elevator (+)
Keskin, 2008	946 Neighborhoods in 32 Districts of İstanbul	To explore the factors that affect housing prices in Istanbul	November - April, 2006	Survey	Hedonic Price Model	**Property Characteristics (+)** **Socio-economic Characteristics** Living Period In Istanbul(+) Average Income (+) Household Size (-) **Neighborhood Quality Characteristics** Neighbor Satisfaction (+) School Satisfaction (+) Health Service Satisfaction (-) **Locational Characteristics:** Travel Time To Job, Schools (-) Earthquake Risk (-) Continent (+) (Europe 1 Asian 0)

4.4. Empirical Literature on Other Countries

The empirical literature can be summarized in 3 groups with respect to the study area as (1) studies on the world, (2) on U.S. and (3) on Europe and Asia. In the first group, studies focus on the impacts of macroeconomic variables as economic activity, interest rates, income, unemployment, consumption and investment, inflation, population density and construction costs etc. on housing prices in different countries (Adams and Füss, 2010; Beltratti and Morana, 2010; Hirata et al., 2012, Mamre, 2014). Among them only (to our knowledge) Mamre (2014) measures the impacts of demand and supply factors separately and finds while housing demand is affected from the real disposable income and structural factors positively, changes in dwelling stock has negative impacts on housing supply (Mamre, 2014). Table 4.2 includes the related studies on the world in the literature.

The second group comprises the studies on the U.S. which are also related to effects of macroeconomic determinants on housing prices in general. Hereby, it is investigated that housing prices of U.S. are prepossessed by employment growth, construction costs, income, population and wealth; to contrary, they are adversely affected from mortgage rate, money supply, monetary policies, land supply, property and income tax rates (Baffoe Bonnie, 1998; Jud and Winkler, 2002; Capozza et al., 2002; Malpezzi et al., 1998; Abraham and Hendershott, 1994; Reichert, 1990). Distinct from these macroeconomic variables, Reichert (1990) and Archer et al. (1996) consider more local variables as seasonality, location and ethnic mix etc.

Apart from all these, the study of Malpezzi et al. (1998) is an only study which considers the division of demand and supply side variables; Reichert's study (1990) is a unique study by evaluating the role of speculation on housing prices. In relation to these, Table 4.3 shows the summary of the housing prices literature about U.S. cities.

The last groups of studies include the empirical studies on the European and Asian housing price appreciation. Similar to others, this literature majorly considers the effects on macroeconomic variables as share price index, foreign direct investment, inflation, wealth, income, unemployment rate, land rent index, real estate stock, economic openness, mortgage rate, money supply, population, GDP (Gross Domestic Product) and exchange rate etc. on housing prices (Abelson et al., 2005; Apergis and

Rezitis, 2010; Hepşen and Vatansever, 2011; Mallick and Mahalik, 2015; Otto, 2007; Wang et al., 2011). Among them, Mallick and Mahalik (2015) and Otto (2007) make differences from other studies with taking attention on the role of speculation. Both of them find out that speculation positively explains the housing price appreciation. By extension, Table 4.4 provides a general overview for the studies on housing prices literature in Europe and Asia.

To conclude, fundamental determinants are dominantly used in the empirical literature. However, there are a few studies that concern the role of speculation (Mallick and Mahalik, 2015; Reichert, 1990; Otto, 2007). Notwithstanding, there are limited number of studies consider regional determinants along with macroeconomic determinants. Furthermore, the majority of studies neglect separating the demand and supply side determinants.

Table 4.2. Related Empirical Studies on the World

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Adams and Füss, 2010	15 OECD Countries	To describe long-term and short-term dynamics of macroeconomic variables on international housing prices	1975-2007	Quarterly	A Panel Co-Integration Analysis	Economic Activity (+) Construction Costs (+) Interest Rates (-)
Hirata, Köse, Otrok and Terrones, 2012	18 advanced OECD Countries	To estimate the global components in house prices and various macroeconomic and financial variables	January, 1971-March, 2011	Quarterly	FAVAR Model	Interest Rates (-) Uncertainty (-) Financial Integration (+) Population Density (-)
Mamre, 2014	21 OECD Countries	To investigate differences in structural or policy factors in house prices	1975-2012	Quarterly	Time Series, Cross Section Random Effects	**Demand Side:** Real Disposable Income (+) Changes in Dwelling Stock (-) Unemployment (-) The Real or Long Term Interest Rate (-) Population Density (-) Structural Factors (+) **Supply Side:** Changes In The Dwelling Stock (-)
Beltratti and Morana, 2010	G-7 Countries	To investigates linkages between general macroeconomic conditions and the housing market for the G-7 area	January,1980-February, 2007	Monthly	VAR Model	The Growth Rates of Real GDP Private Consumption and Investment (+) The Rate of CPI Inflation (+) The Levels of the Long-Term And Short-Term The Nominal Money Growth Rate (+)

Table 4.3. Related Empirical Studies on the United States

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Baffoe Bonnie, 1998	U.S.	To emphasize short and long effects of monetary policies and other macroeconomic variables on housing prices	1973-1994	Quarterly	VAR Method, Unit Root Test	Employment Growth (+) Mortgage Rate (-) Inflation (+) Money Supply (-) Monetary Policies (-)
Jud and Winkler, 2002	130 Metropolitan Areas across the U.S.	To examine the factors that influence real housing prices changes	1984-1998	Annual	A Fixed Effects Model	Construction Costs (+) Real Income (+) Real Wealth (+) Population (+) Real After Tax Mortgage Interest Rates (+)
Capozza, Hendershott, Mack and Mayer, 2002	62 Metro Areas in U.S.	To explore the dynamics of real house prices by estimating serial correlation and mean reversion coefficients from a panel data set	1979-1995	Annual	Panel Regression	Population (+) Income (+) Real Construction Costs (+) Land Supply (-) Mortgage Rate (-) Property Tax Rates (-) Income Tax Rates (-)
Malpezzi, Chun and Green, 1998	272 Metropolitan Areas from U.S.	Analyzing the determinants of housing prices with the particular focus on the supply side determinants	1990	Decennial Census	Hedonic Model	**Demand** Income (+) Demography (+) **Supply** Prices (+) Topographical Constraints (+)

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Table 4.3. (Cont.)

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Abraham and Hendershott, 1994	30 Cities in U.S.	To describe determinants of real house price appreciation	1977-1992	Annual	Capozza and Helsley Model	Growth in Real Income (+) Real Construction Costs (+) Changes in the Real After-Tax Interest Rate (+)
Reichert, 1990	4 Broad Regions of U.S.	To Identify Important differences in the way new housing prices react to local and national economic factors	1975-1987	Quarterly	Equilibrium Model	Interest Rates (-) Permanent Income (+) Construction Cost/Quality (+) Speculation (+) Population (+) Employment Rate (+) Mortgage Rates (-) Seasonality (+)
Archer, Gatzlaff and Ling,1996	Florida, Miami	To examine the locational variation in house price changes in Dade County	1971-1992	Annual	Repeat-Sales Model, The Tiebout Model, Monocentric Model	Location (+) Distance from the CBD (-) Population (+) Housing Units (-) Ethnic Mix (-) Housing Age (+)

Table 4.4. Related Empirical Studies on the Europe and Asia

Authors	Study Area	Aim	Period	Data Frequency	Method	Results
Mallick and Mahalik, 2015	15 Major Cities of India	Comparing fundamental factors to speculative factors for explaining housing prices	2010-2013	Quarterly	A Panel Regression Model	Speculation (+) Share Price Index (+) Non-Food Bank Credit (+) Foreign Direct Investment (+) Inflation(-) Wealth (-)
Wang, Yang and Liu, 2011	35 Large Cities of China	To identify the impact of urban economic openness on regional real estate prices	1998-2006	Annual	Panel Data Technique	Registered Urban Unemployment Rate (+) Urban Land Rent Index (+) Real Estate Stock (+) Economic Openness (+)
Apergis and Rezitis, 2010	Greece	To investigate short and long run effects of macroeconomic variables on the price of new houses sold in Greece	1981-1999	Quarterly	ECVAR Model	Inflation (-) Consumer Prices (+) Employment Rate (+) Mortgage Rate (-)
Otto, 2007	Australian's Capital Cities	To examine the ability of std. economic factors to explain the growth of real house prices	1986-2005	Annual	Unit Root Test, F-Test	Mortgage Rate (-) Inflation (+) Price/Rent Ratio (-)
Hepşen and Vatansever, 2011	Dubai	To investigate whether there is a long-run relationship between macroeconomic indicators and property price index in Dubai	January 2003-December 2010	Monthly	Co-Integration Analyses	Gold Price Index (+) Total Direct Foreign Trade (+) Number Of Completed Residential Units (-)
Abelson, Joyeux, Milunovich and Chung, 2005	Australia	To explain changes in real house prices in Australia from 1970 to 2003	1970-2003	Annual	Asymmetric Error Correction Model	Real Income (+) Inflation (+) Unemployment Rate (-) Mortgage Rate (-) Equity Prices (-) Exchange Rate (-)

CHAPTER 5

EMPIRICAL ANALYSES AND RESULTS

This chapter begins with descriptive and exploratory analysis in order to provide general overview for realizing current state of regional housing market in Turkey. Afterwards, the following two sections include time series (VAR) and cross-sectional analysis separately. While, time series analysis (VAR) are considered to demonstrate the role of speculative and fundamental factors, cross-sectional analysis are implemented to find out which factors lie behind the differences between regional house price appreciations.

5.1. Descriptive and Exploratory Analyses

5.1.1. Descriptive Analyses

Initially, to understand how Turkish regional housing price appreciation changes in general, basic descriptive statistics are used. Regarding this, regional housing prices in Turkey are obtained from Central Bank Republic of Turkey for the period 2010:1-2016:9. So, Figure 5.1 illustrates the evolution of these housing price indexes for 26 regions (Assuming 2010=100). It can be obviously inferred from the figure that housing prices have tendency to increase in all regions; but, the paces of increase vary across them. For instance, while some regions reach to an index number of 280 which correspond to 180% price increase in 6 years, some other regions can only reach to 140 which correspond to 40% increase in 6 years. Hence, the results indicate that housing price appreciations are quite heterogeneous across regions and the extent of imbalances in the housing market makes the study area more interesting per se.

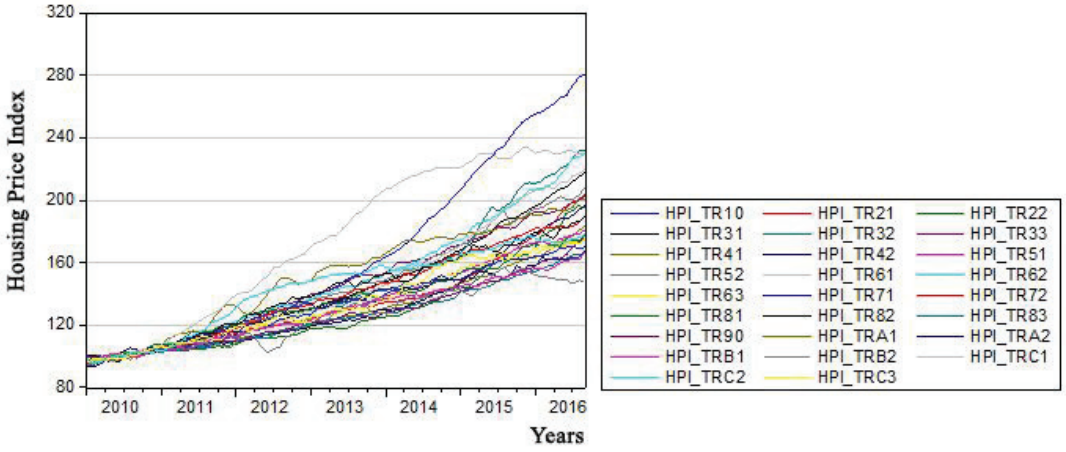

Figure 5.1. Evolution of Regional Housing Prices in Turkey (Assuming 2010=100), 2010:1-2016:9 (Source: CBRT, 2016)

Additionally, the current characteristics of housing price appreciations are summarized in Table 5.1 by descriptive statistics. In this table, HPI_ 2011 (%) represents the percentage increase in housing prices between January-2011 and January-2010. Similarly, HPI_2015 (%) denotes the percentage increase between January-2015 and January-2014. These results specify that while average housing price appreciations are about 8.3% in 2011, they increase approximately 12.5% in 2015. So, they reveal that housing price appreciations become accelerated in recent years. Considering standard deviation of price appreciations, it raises at about 6.3% from 3.5% in 5 years. It means that regions become more heterogeneous in housing price appreciations. Moreover, skewedness and kurtosis of the distribution also increase considerably. In none of the years the distributions are found to follow a normal distribution as indicated by Jarque Bera Test statistics.

Table 5.1. Descriptive Statistics on Regional Housing Price Increases in Turkey

Measure	HPI_ 2011 (%)	HPI_2015 (%)
Mean	8,31	12,46
Std. Dev.	3,52	6,28
Std. Dev./Mean	0,42	0,50
Skewness	0,45	0,57
Kurtosis	1,94	2,35
Jarque-Bera	2,10	1,86
Jarque-Bera (Probability)	0,35	0,40

In addition to descriptive statistics Kernel probability distribution function is used to understand the distribution of the housing price appreciations across regions. While in 2011 the distribution exhibits a high mode around median values, in 2015 it appears rather a more dispersed distribution with lesser probability around the median values.

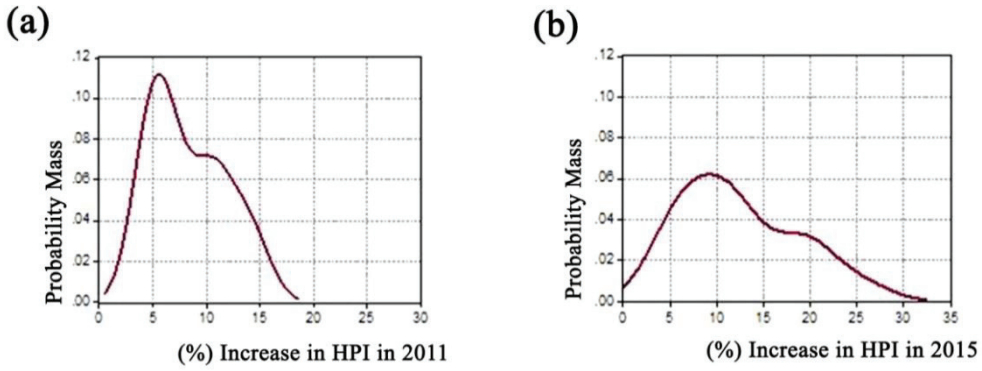

Figure 5.2. Kernel Probability Distribution of Regional Housing Price Increases (%)

All these findings point to a common result: housing markets in Turkey show a tendency to become more heterogeneous over time and housing price appreciations across regions tend to diverge from each other.

By the way, we have to consider that this period includes some crucial social and political issues in Turkey and its surrounding countries. To illustrate, Syria civil war has started in 2011 and with the Guidelines for the Adoption and Hosting of the Citizens

of the Syrian Arab Republic and the Non-Stateless Persons Residing in the Syrian Arab Republic for the purpose of Community Refuge in Turkey, a vital immigration process emerges. According to 2017- 2021 Strategic Plan of Turkish Republic Ministry of Interior, General Directorate of Immigration Authority, Turkey has accepted 2.834.441 person from the Syria since April, 2011 by temporary protection (Turkish Republic the Ministry of Interior; General Directorate of Immigration Authority, 2016).

Furthermore, Turkey started to Solution Process in 2010, related to terrorism; but, it ended in the middle of the 2015 (Köse, 2017). These social, economic and political decisions have major impacts on housing sector and demand, especially on the eastern and south-eastern parts of Turkey.

At last, geographical distribution of the housing price appreciation is illustrated as a useful indicator to execute the significance of this subject. In order to elaborate on diversity and alteration of housing price appreciation between regions, different housing price appreciation maps are prepared for 3 periods as (1) 2011, (2) 2015 and (3) 2011-2015. All data are obtained from the Central Bank of Turkish Republic for the each period between 2011 and 2015 which are available on its website. These data are measured in percentages and implemented on maps with the help of Adobe Photoshop CS6. In these maps, the highest and the lowest 9 regions are separated due to the rate of housing price appreciation. The dark red color represents the most rapidly appreciating regions, whereas light pink colored regions are the ones which exhibit slowest appreciation.

To the extent that the map of distribution of housing price appreciation in 2011 and 2015 are prepared separately.

It can be noticed from the Figure 5.3 that high appraisals agglomerate on middle, eastern and south-east parts of Turkey in 2011. Moreover, TR81 region has the highest appreciation rate about 15.3%. It might point to the impacts of industrial activities. Besides, 3 major regions as TR10, TR31 and TR51 experience moderate increases in housing prices by the virtue of housing supply, job or education opportunities and cultural facilities presumably. Also, the appreciation rates of south-east parts might be the result of immigration.

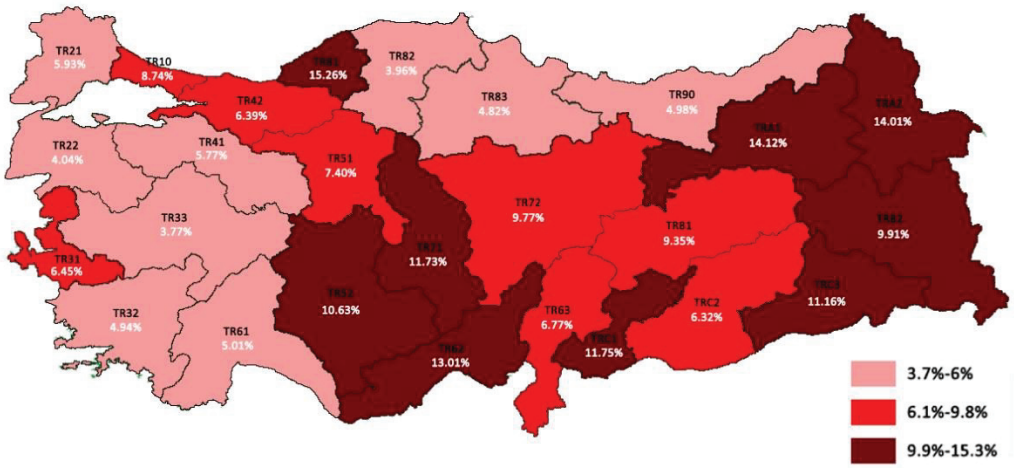

Figure 5.3. Geographical Distribution of Housing Price Appreciation in 2011 (Source: CBRT, 2016)

To contrary, Figure 5.4 is quite opposite of Figure 5.3, because, higher rates concentrate on the north-west, west and south-west parts in 2015. At a glance, these increases might be indicative of job opportunities, cultural and tourism activities, health and education facilities or climatic conditions.

In depth insights, TR22 region reaches about 26.7% increases, comparing with the highest appreciation in 2011, it is almost double. It reminds us to climatic, temperature and seaside opportunities of this region.

Moreover, it seems that while rates of TR10, TR21, TR22 and TR42 regions might be influenced from the job, health and education factors, rates of TR32, TR52, TR61 and TR62 might be the results of tourism and temperature factors.

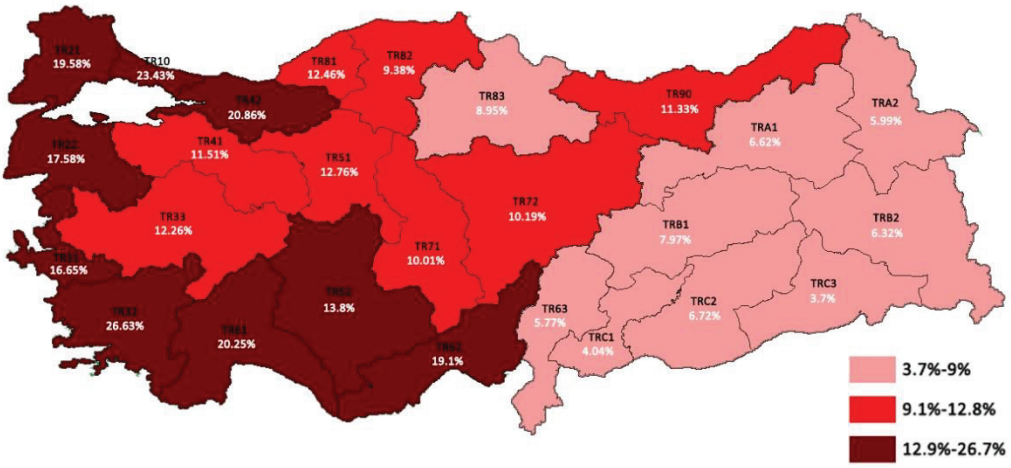

Figure 5.4. Geographical Distribution of Housing Price Appreciation in 2015 (Source: CBRT, 2016)

For further analysis, Figure 5.5 represents average annual percentage increase in housing prices for 2011 and 2015 across regions. Herein, average annual increases changes between about 7.4% and 18.5%. As expected the highest increase in TR10 region which represents İstanbul province. This increase should be because of having a great number of large scale urban developments, urban transformation, renewal, residence and skyscraper projects, related to real estate economy acutely.

Besides, may be with the effect of being close to İstanbul and having great industrial activities, TR42 region (Kocaeli, Sakarya, Düzce, Bolu and Yalova Provinces) also experiences a high rate of housing price appreciation as approximately 11.6%. Moreover, TR21, TR81 and TR33 regions stand out, probably with the help of industrial activity.

With a general view to the whole map, it seems south-west and west parts of Turkey have more housing price appreciation. These may arise from having goods weather conditions, good living conditions and tourism activities. These parts include İzmir province which has the second housing price increase rate (12.08%).

Furthermore, while the south-west and west parts of Turkey experience important price increases, north-east, east and south-east parts have the lowest rates. These results remind us the political, topographical and climatic conditions.

At last, there are some other points to need an attention, TR41, TR63, TRC1 and TRC3 regions. For instance, while surround regions have a quite high price

increases, TR41 region (Bursa, Eskisehir and Bilecik Provinces) and TR63 (Hatay, Kahramanmaraş and Osmaniye Provinces) region have rather low price increases. In addition, TRC1 (Gaziantep, Adıyaman and Kilis Provinces) and TRC3 (Mardin, Batman, Şırnak and Siirt) have more increases in housing values comparing other regions around them. It might be the effect of Syrian immigration.

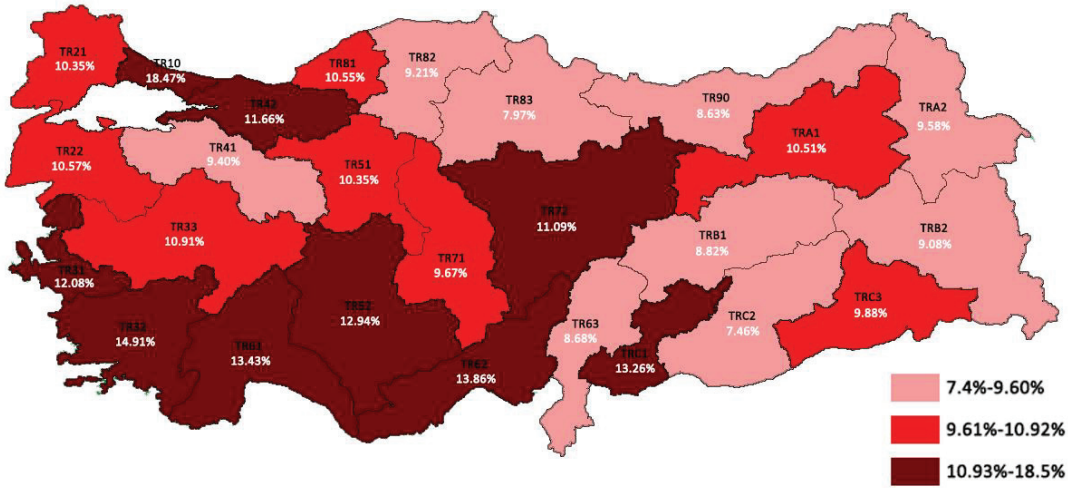

Figure 5.5. Geographical Distribution of Housing Price Appreciation, Average of 2011 and 2015 (Source: CBRT, 2016)

To conclude, two main features seem to exist. First, housing prices in South Western, Aegean and Mediterranean coastal regions display a very rapid appreciation. This makes us consider the importance of climate and cultural determinants which are the variables largely ignored in the existing literature. Second, industrial belt of Turkey seem to display a very quick appreciation (such as Istanbul (TR10) and Kocaeli (TR42). Third, north coast and eastern part of Turkey seem to have modest appreciations.

Overall, we understood from this explanatory analysis that our study place is a complicated one since it contains large regional asymmetries.

5.1.2. Exploratory Analyses

After composing an overview of regional housing appreciations, we prepared in this part some illustrations to detect geographical distributions of some variables. Herein, these variables that might affect housing prices are determined in accordance with the literature. To make more elaboration on these different variables we divided them into 5 groups as economic, demographic, urbanization, climatic and geographic and cultural variables. At this juncture, maps are prepared for 26 Nomenclatures of Units for Territorial Statistics (NUTS 2).

5.2.1. Economic Variables

This part deals with economic variables such as employment rate, regional inflation, trade openness and labor participation rate of regions. These variables often influence income level of regions. As far as possible, illustrations are prepared for the years of 2010 and 2015.

At first employment rate of regions, published by TURKSTAT (For +15 Years Old), are examined as a demand-side economic variable. In relation, the hypothesis here is, higher employment rates triggers to housing prices in regions by providing sustained income (Apergis and Rezitis, 2010; Reichert, 1990; Sarı et al., 2007).

Herewith, Figure 5.6 (a) demonstrates employment rates in 2010 while Figure 5.6 (b) indicates these for 2015. Comparing these two maps, it can be seen that employment rates declined in 2015. In 2010 the highest rates reach to 54.6%; but, they decline at about 53.5% in 2015. These decreasing rates can also sign to fall in purchase power of regions.

In detail, higher employment rates concentrate on south-western, north-western and north-eastern regions. Another thing that stands out here is the employment rates of TR10, TR31 and TR51 regions. Although these regions involve 3 major metropolitan cities of Turkey, they face the risk of unemployment.

Generally, if there are upward movements on housing prices in dark-red colored regions, we expected that they might be because of the employment rates.

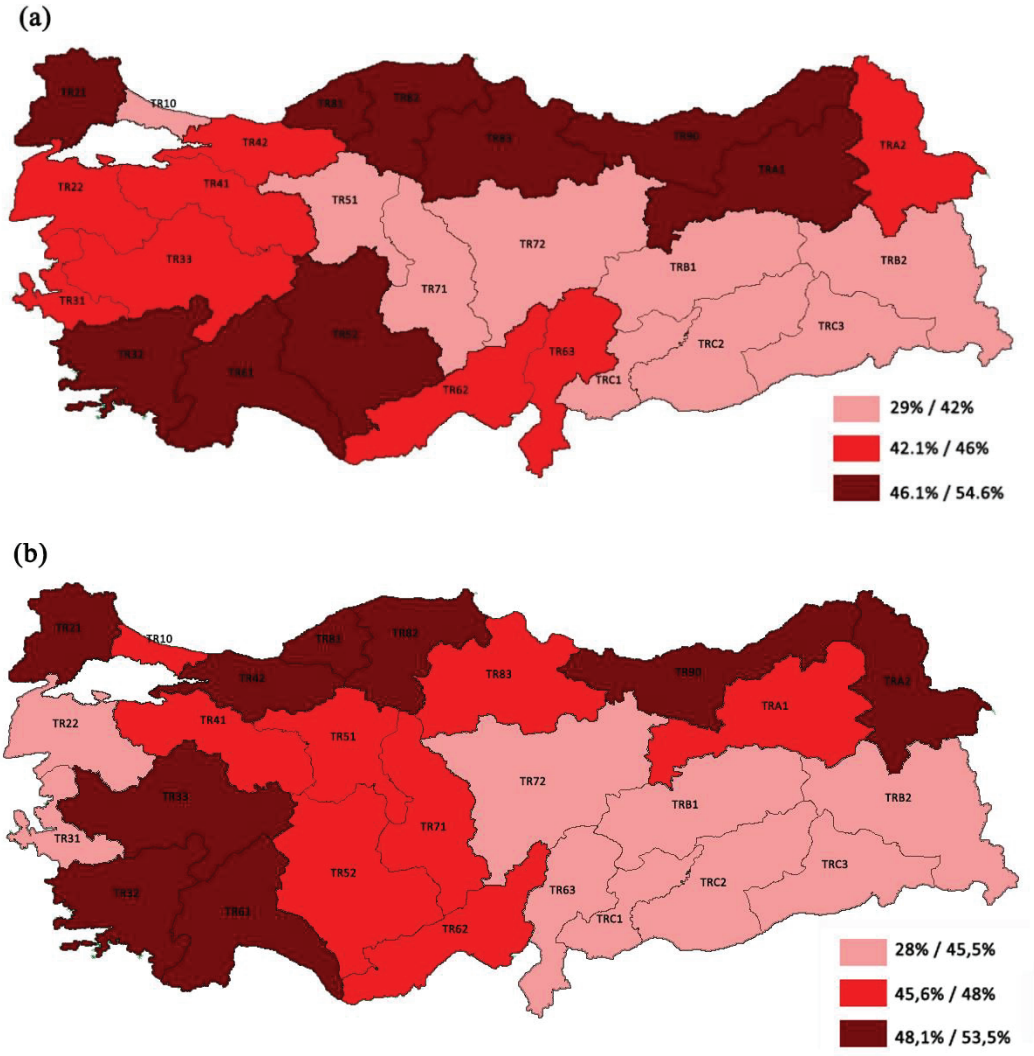

Figure 5.6. Geographical Distribution of Employment Rates (%), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

Secondly, regional inflation rates are considered to affect both demand and supply-side decisions. In the literature, the direction of the relation between inflation rates and housing prices is not obvious.

In this study, monthly consumer price indexes are used to measure the changes in regional inflation rates officially by Turkish Statistical Institute (TURKSTAT, Assuming 2003=100). Besides, Consumer Price Indexes (CPI) are obtained from CBRT (Central Bank of The Republic of Turkey, 2016).

In light of this knowledge, considering the Figure 5.7 (a), it can be noticed that high inflation rates are concentrated on middle Anatolian, western and eastern parts of Turkey and it changes around 8,2% and 11% in 2010. With reference to these results,

housing prices of these parts either are expected to be higher in concert with higher inflation rates or to contrary, be lower due to the higher inflation.

On the other hand, due to the Figure 5.7 (b), in 2015, higher inflation rates become dense mostly western, the middle of the Anatolian and southern parts. According to this illustration, housing prices might be more appreciated in these parts by the virtue of higher inflation rates or vice versa.

In depth, the highest inflation rates change between 9.5% and 10.8% in this time. It is also worth noting here that although the highest inflation rate demonstrates a little decrease; the higher values of 2010 substitute almost the lowest rates of 2015. With reference to these results, housing prices of these parts either are expected to be higher in concert with higher inflation rates or to contrary, be lower due to the higher inflation.

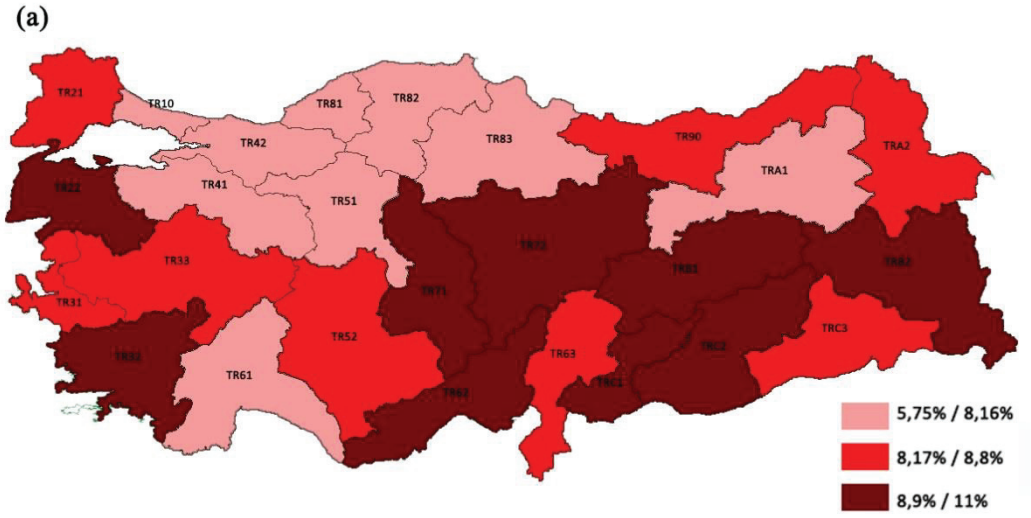

Figure 5.7. Geographical Distribution of Changes in Regional Inflation (%), 2010 (a) and 2015 (b) (Source: CBRT, 2016)

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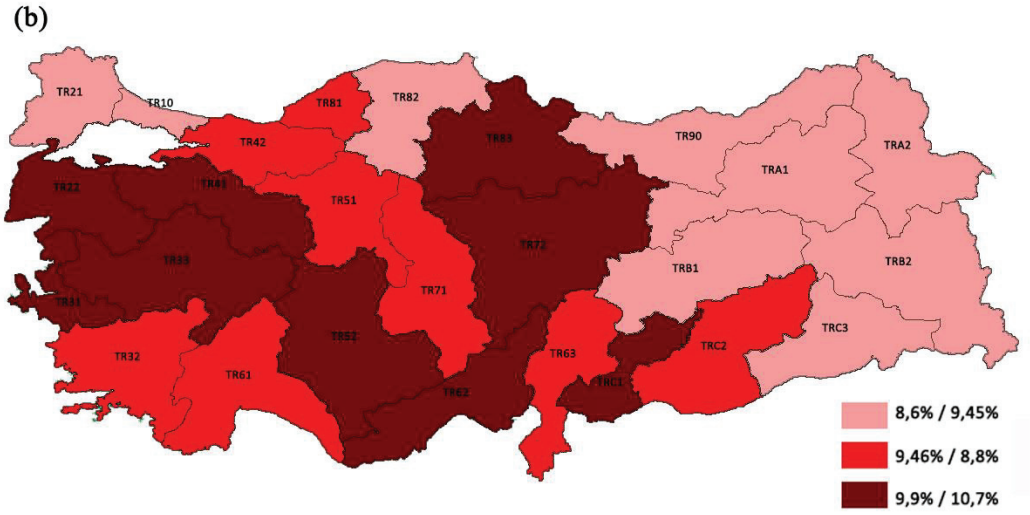

Figure 5.7. (Cont.)

As another demand-side economic variable, trade openness of regions are dealt to determine areas that stand out in this regard and to observe impacts on housing prices. It represents integration between regional and international markets.

To extent, Figure 5.8 (a) shows the trade volume of regions relative to population in 2010. Herein, 3 major region of Turkey as TR10, TR31 and TR52 (İstanbul, İzmir and Ankara), TR33, TR42, TR41,TR81 regions and TR63, TRC1 regions draw an attention, probably due to their industrial activities and international harbors. It is expected that outward oriented regions confront with higher housing prices in associated with higher income levels. This figure also signs the inequality across regions because while the highest rates changes from 2.000$ to 11.000$, the lowest values are around 74-570$ per capita in 2010.

Besides, Figure 5.8 (b) represents trade openness of regions in 2015 and it is quite similar with map in 2010. When it comes to 2015, it is still seen that the inequality between the regions continues, only the highest trade volume increases to 13.500$ per capita.

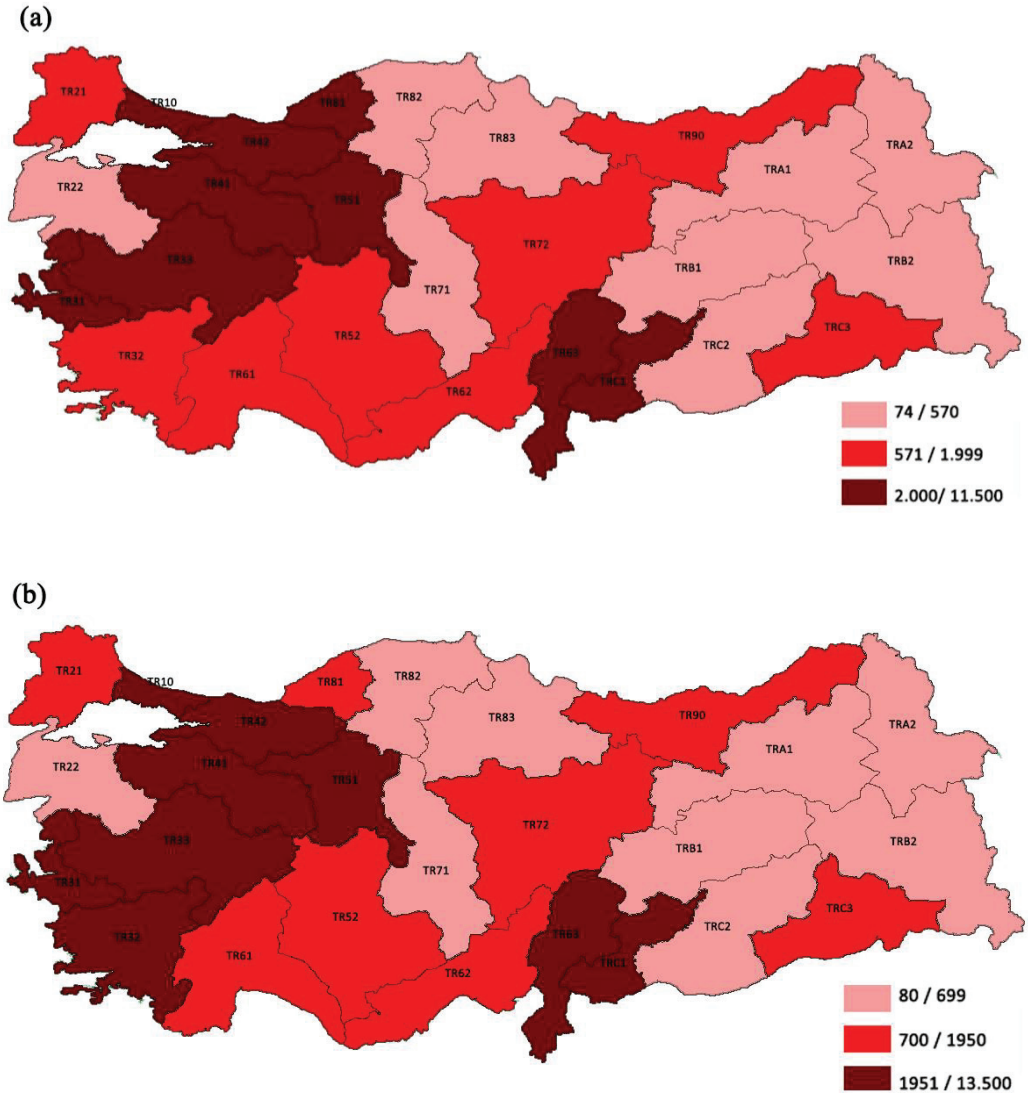

Figure 5.8. Geographical Distribution of Trade Openness ($-per capita), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

Labor Participation rate is other significant demand-side economic variable. It is measured by dividing the number of population at the age between 15 and 65 to the total population of each region.

To extent, due to the Figure 5.9 (a), it seems that map can be fictionally divided into 3 parts in terms of labor participation rates as western, middle and eastern. These rates are about 70% in the western parts, in the western parts, and lower in east in 2010.

In 2015, geographical distribution of labor participation rates does not change much. Just the highest rates dense in the north-west parts in this time and the rates of some regions as TR32 and TR72 decline (Figure 5.9 (b)).

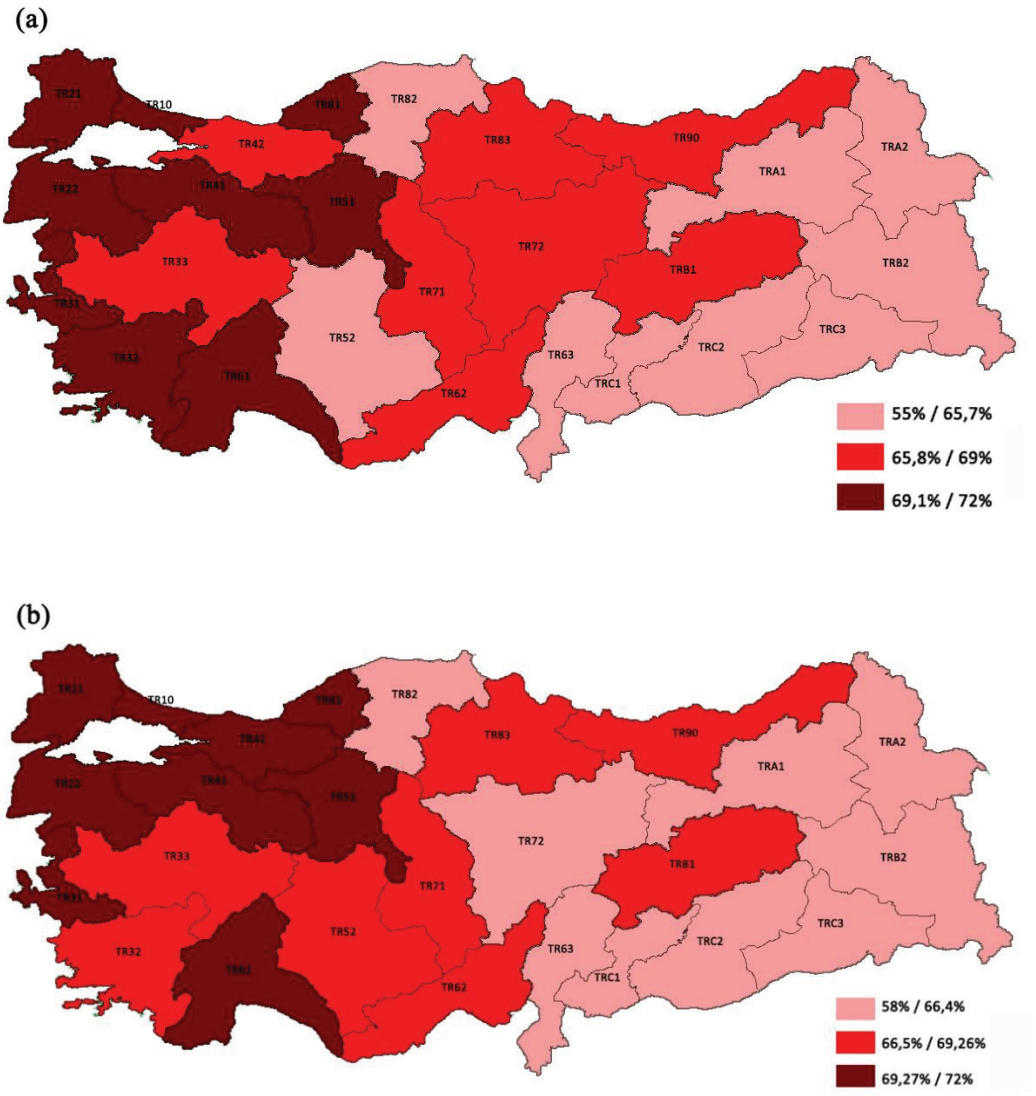

Figure 5.9. Geographical Distribution of Changes in Labor Participation (%), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

5.2.2. Demographic Variables

This part concerns with demographic variables such as population, population density, net migration rate, student ratio, student-teacher ratio, bachelor rate (education level), age dependency and household size of regions.

First of all, population of regions, which is the most studied variable on housing issue, is considered. Archer et al. (1996), Capozza et al. (2002), Jud and Winkler (2002), Reichert (1990) find that population affects real estate prices positively. The data is obtained for the period 2010-2015 from TURKSTAT.

According to the Figure 5.10 (a) population does not spread equally across regions. The highest populations, represented dark red color, change between about 2.9 and 13.5 million and this range alone can be evidence to determine inequality across regions. It can be observed from the Figure 5.10 (a) that the middle and southern regions of Turkey are more crowded regions in 2010. The dark red regions at the north-west part, including 3 major cities, might dense because of the job opportunities on the occasion of industrial activities and service sector. Besides, other dark red regions might be crowded due to the migration.

Looking at the Figure 5.10 (b), represents populations in 2015, is very similar to population distribution of 2010. Only this time, population of TRB2 region increases slightly than TRC3 region.

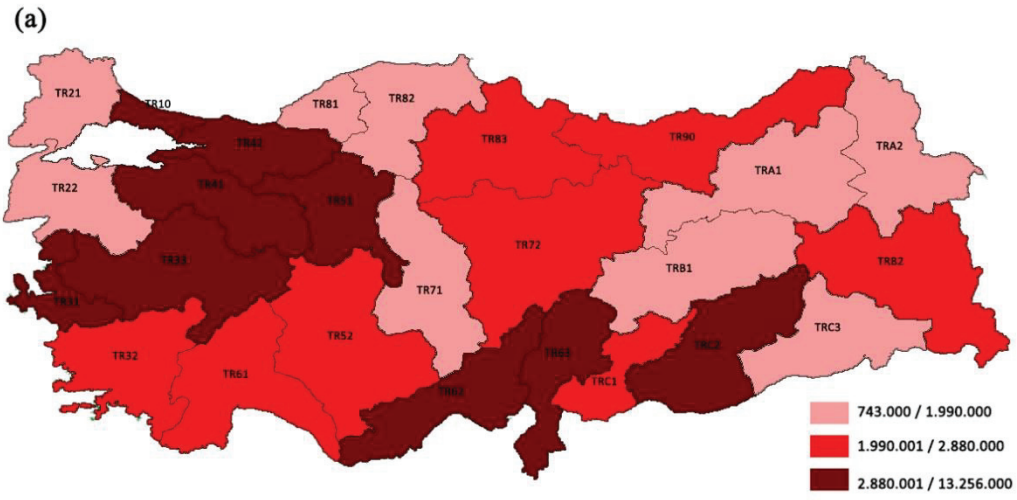

Figure 5.10. Geographical Distribution of Population (Person), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

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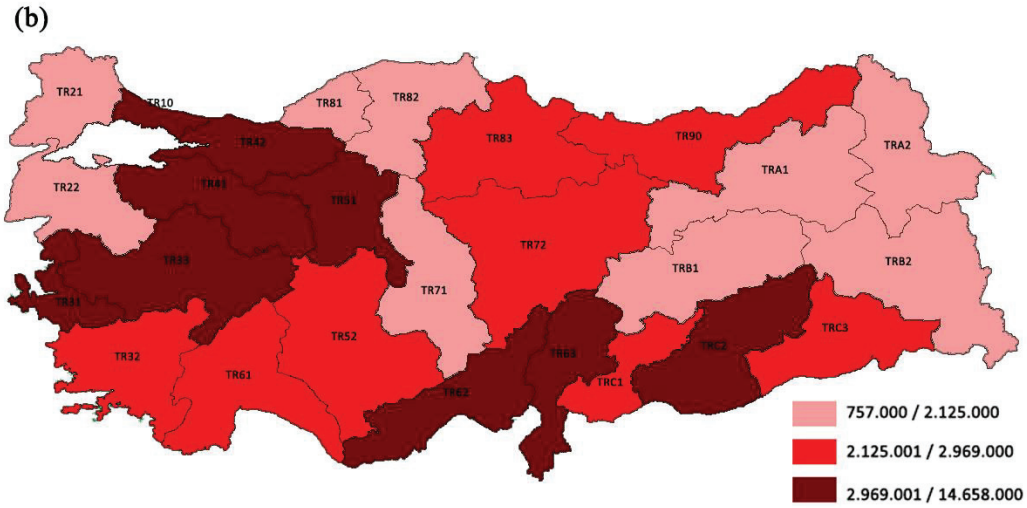

Figure 5.10. (Cont.)

As another demographic variable, net migration rate. This variable is acquired from TURKSTAT. Even if we tried to consider also Syrian migration, we did not reach this data for each region specifically. Thus, it is a part of limitations in this study.

Figure 5.11 (a) displays net migration rate of regions in 2010. At a first glance, it seems that regions in north-eastern and eastern (pink and red colored) are faced with shrinking population, to contrary, north-western, western and southern parts of Turkey come into prominence by immigrant-receiving. Elaborately, the lowest rates changes between -16.5% and -6.5%; but, the highest rates are about 1-10.5%. Further, population decline in also red colored regions about -6.6-0%. To this respect, housing prices are supposed to be superior in dark red colored regions, while the boot is on the other foot of red and pink colored regions.

Comparing to 2010, the lowest immigration rate decreases from -16.5% to about -26%, meanwhile, the highest rate reaches at 15% in 2015. It can be inferred from the Figure 5.11 (b) that the regions in eastern parts of Turkey face with the crucial risk of decreasing population in 2015. Therefore, housing prices are expected to fall in especially eastern parts of Turkey, on the contrary to the western parts with the effect of migration.

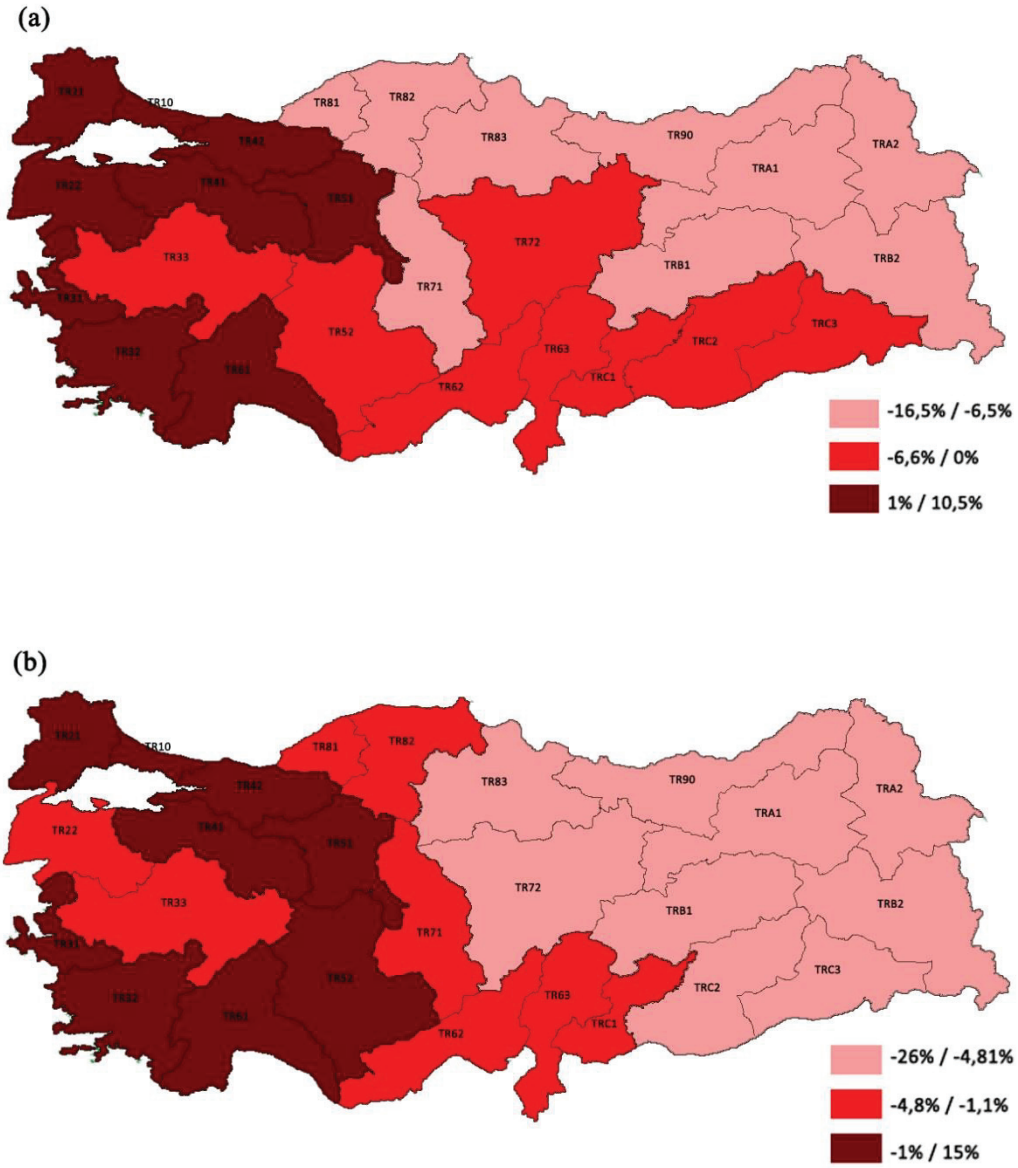

Figure 5.11. Geographical Distribution of Net Migration Rate (%), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

Another demand-side factor is student ratio. Generally there is a rise in demand and a burst of housing prices in places where a new university is established. In this present study, student density variable measured by dividing the number of university students to total population of regions which are obtained from TURKSTAT.

In 2010, 34-50 people from every 1000 people are university student in dark red colored regions (Figure 5.12 (a)). This range asserts that some regions come to the fore in terms of having great number of students.

Compared to 2010, the rates of student ratio increase in all regions in 2015. The highest rate is between 0.052-0.77 which means about 52-770 of the every 1000 people are university student in some regions (Figure 5.12 (b)).

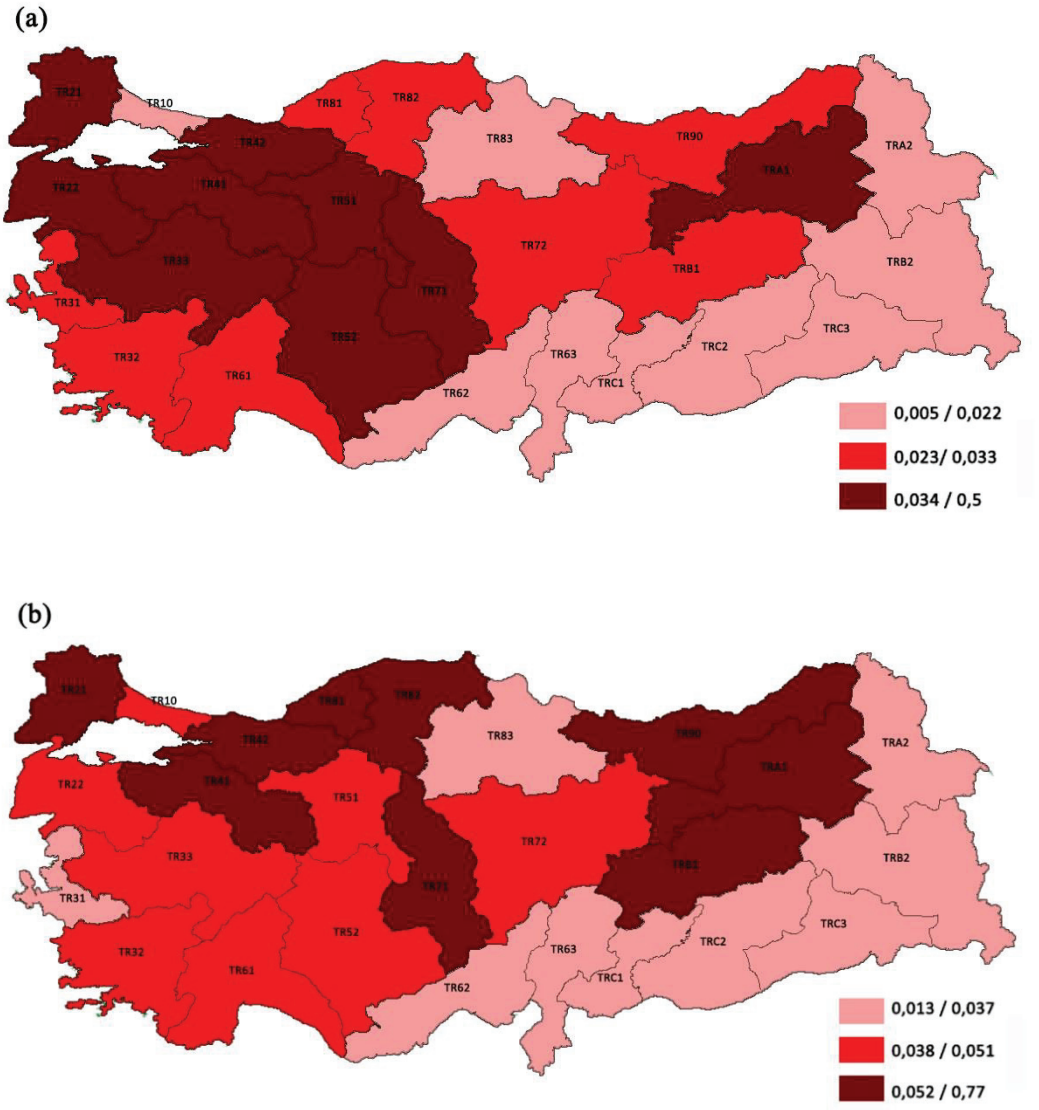

Figure 5.12. Geographical Distribution of Student Ratio (Person), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

As another demographic variable student-teacher ratio of regions are used. It seems that as quite similar with student density; but, this data is considered as number of students per teacher. Both of the data is obtained from TURKSTAT.

To deep insight, parents might be expectant to more interest and attention from a school in particular, so they prefer to study at schools that provide more teachers or have less student density. Thus, housing demand is assumed to be higher in regions which have lesser student numbers per teacher.

In 2010, it increases from north-western to south-eastern regions (Figure 5.13(a)). In 2015, visual hasn't change; but, numbers of students per teacher has decreases a few (Figure 5.13(b)).

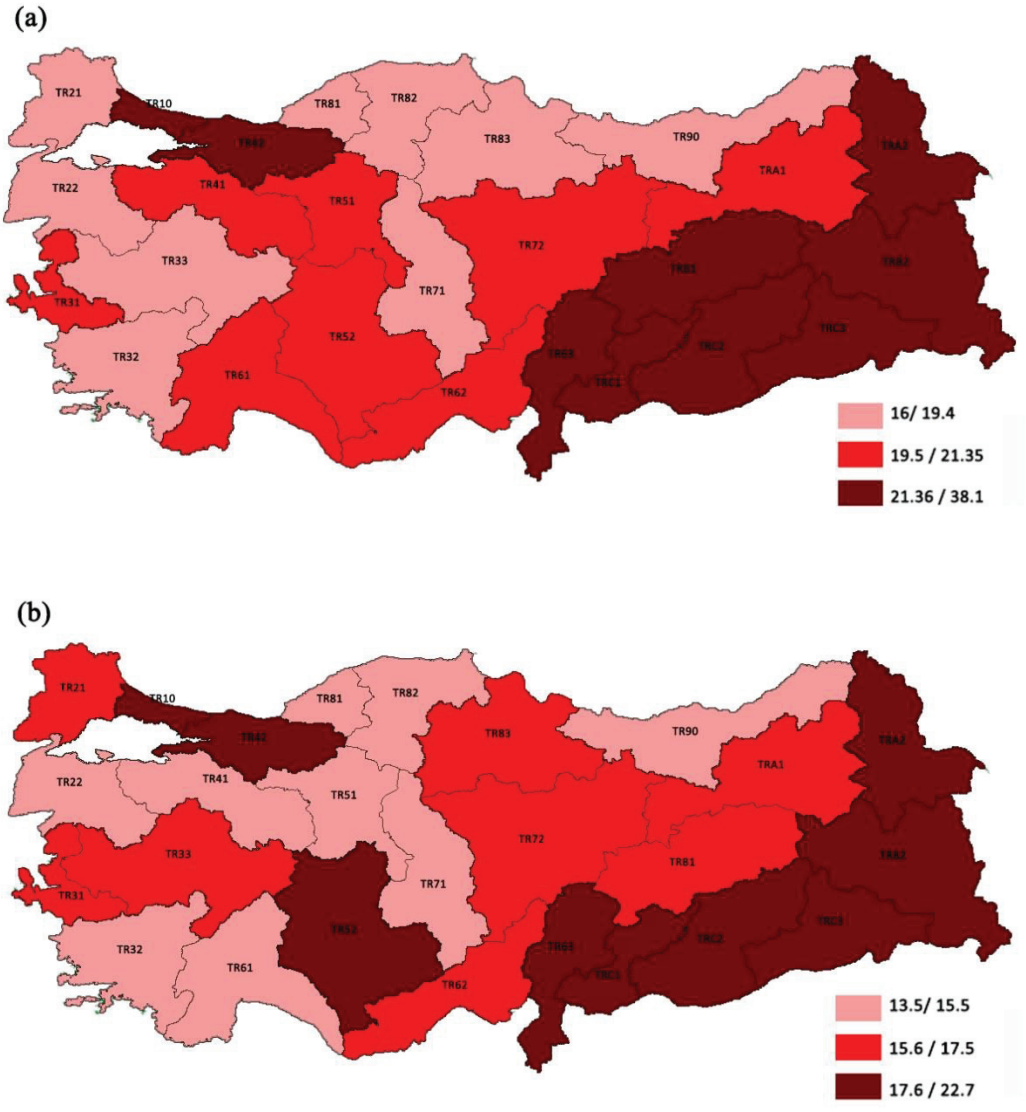

Figure 5.13. Geographical Distribution of Student-Teacher Ratio (Number of students-per teacher), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

Another demographic variable is bachelor degree rate (Education level) of regions. This variable is calculated by dividing the number of people having bachelor, master and doctorate degree to the total population. These data are collected from TURKSTAT separately.

Overall, the western part of Turkey, except TR33, has the highest degrees and the rates decline towards to eastern (Figure 5.14 (a)). For more detail, lower rates are between 0.023-0.053, higher rates reach at 0.13 in 2010 which means about 13 of the every 100 people have bachelor degree at least. The map of 2015 is quite similar with 2010, merely the rates increases to 0.058- 0.191 (Figure 5.14 (b)).

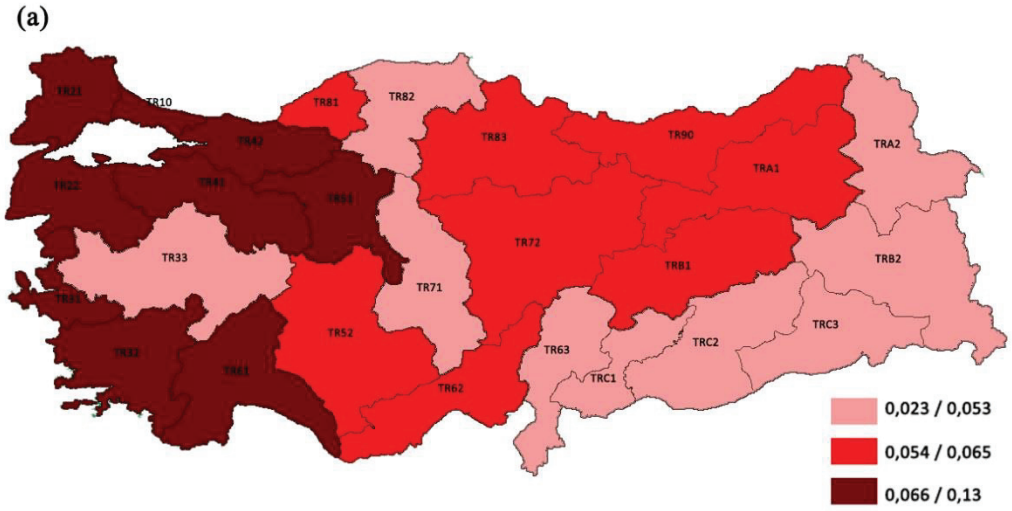

Figure 5.14. Geographical Distribution of Bachelor Degree Rate (Education level) (Person), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

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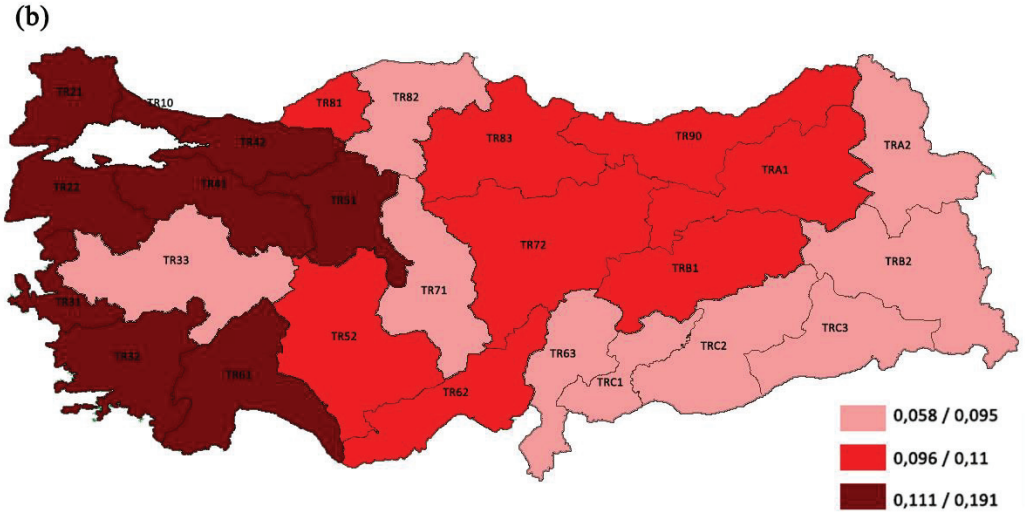

Figure 5.14 (Cont.)

Moreover, age dependency rate of regions are measured. The hypothesis is the age dependency rate is high in a region, housing demand reduces, and so housing prices decline as well. Because, when age dependency rates rise in a region in economic aspects, people tend to accommodate with their families. In the opposite case, if age dependence rates are low in a specific region, it means more property might be afforded.

For the present study, age dependency rates of regions are acquired from TURKSTAT, and refer to the number of people (Between 0-14 or above 64 years) who must be looked after by a person (15-64 years).

Regarding Figure 5.15 (a), age dependency rates reaches 82% in the middle and eastern parts of Turkey, while they are about 40-45% in western parts in 2010. Correspondingly, it can be estimated that eastern parts have economic difficulties in affording a new property.

In 2015, the illustration shares a similar feature with the map (a). Just, the highest rates decline at 72% in 2015 (Figure 5.15 (b)).

As a result, if there are an excess increases on housing prices in dark red colored regions, they might depend on higher age dependency rates.

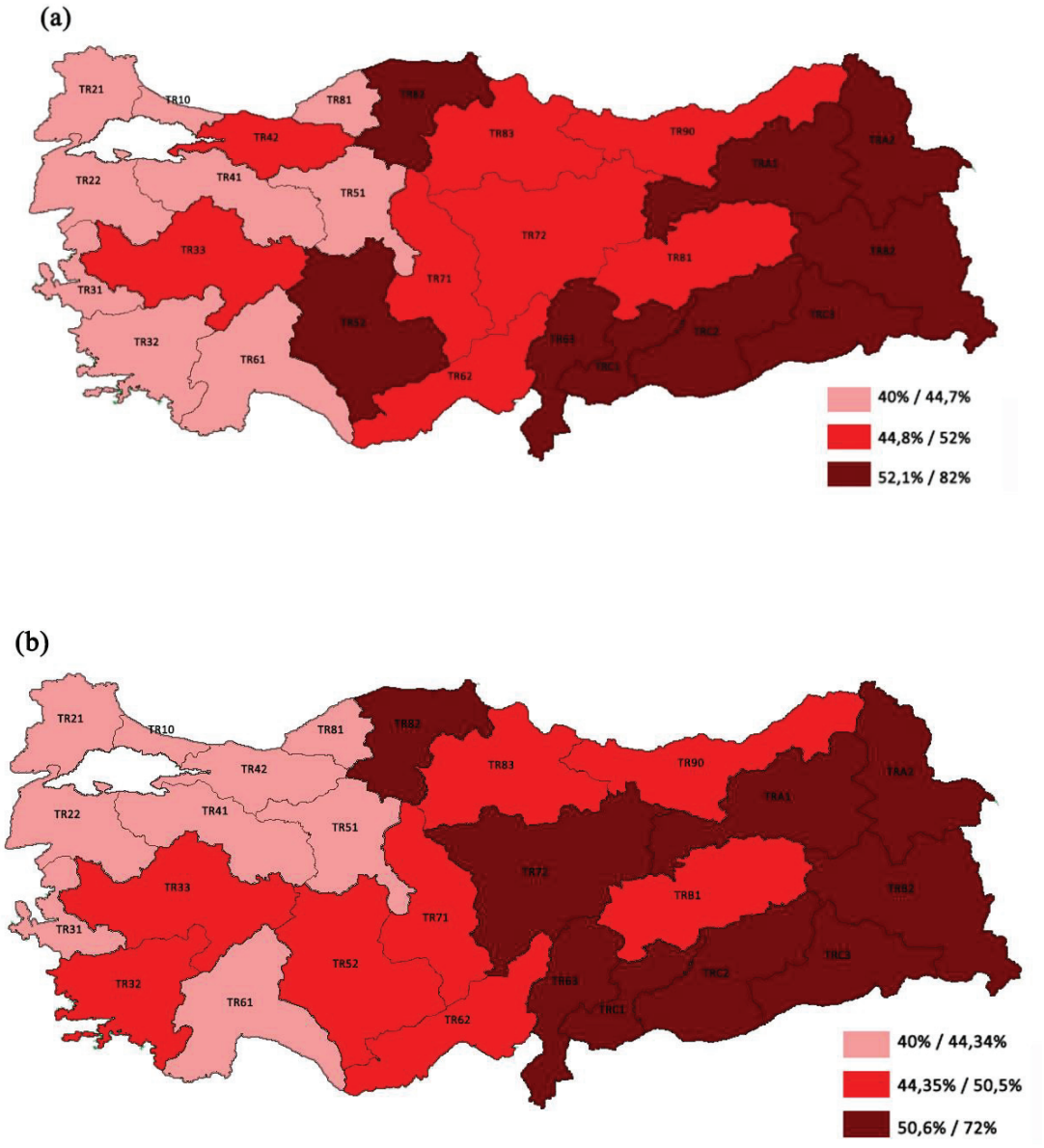

Figure 5.15. Geographical Distribution of Changes in Age Dependency (%), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

On the other hand, household sizes of regions are illustrated. We suppose that if household size is less in a region, more people demand housing and housing prices increase. Thus, according to the Figure 5.16, eastern regions have more crowded families, associating with this, housing demand lesser than western regions. On the contrary, it is seen that the household size in the west is about 3-3.5 person, and in this case it is expected that there will be more requests for housing in this area.

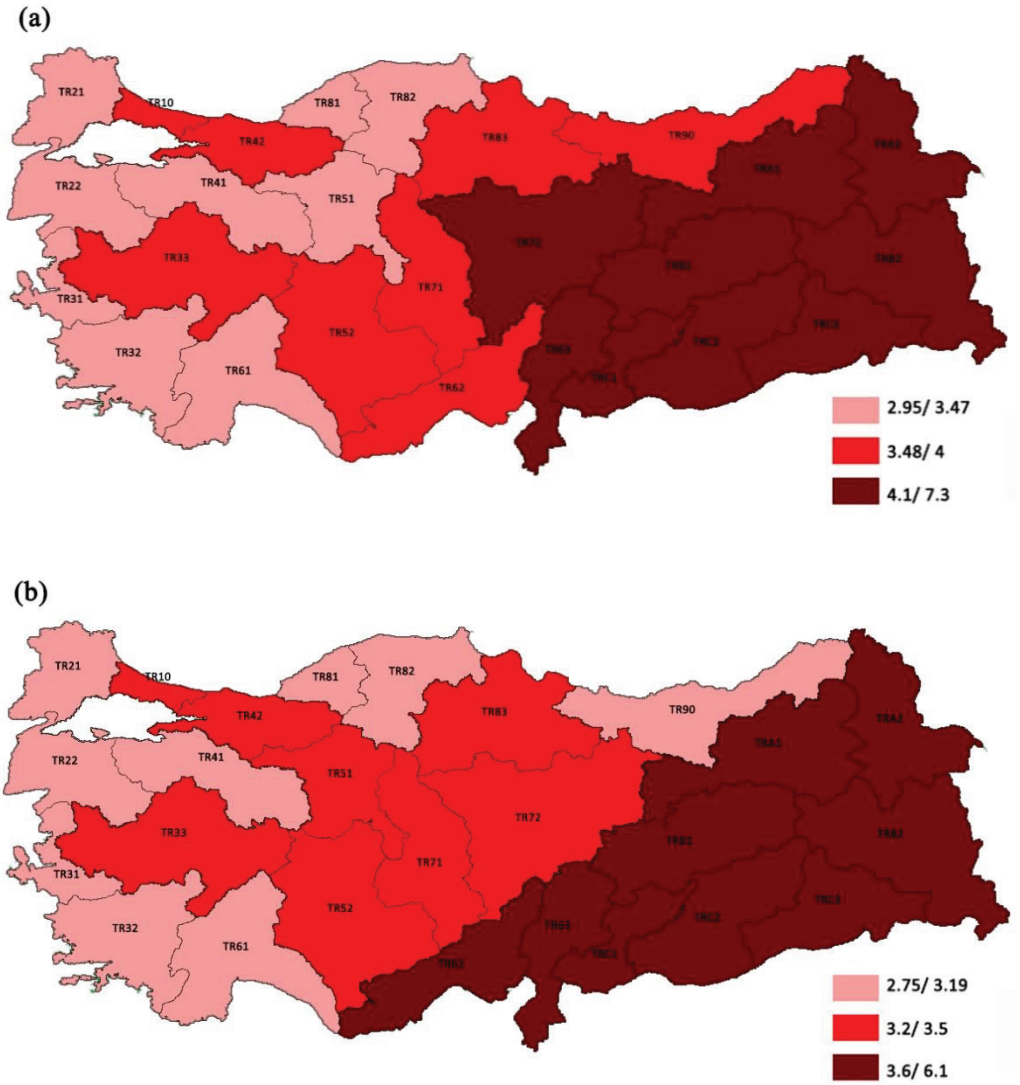

Figure 5.16. Geographical Distribution of Regional Household Size (Person), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

5.2.3. Urbanization Variables

This part concerns with urban variables as urbanization rate, population density, road ratio, vehicle ratio, inverse land supply, crime rates (Inversed security level) of regions. These variables impacts on housing demand in associated with housing prices.

First of all, we dealt with the relation between urbanization rates of regions and housing prices. The variable, which refers to percentage of people living in urban areas, is acquired from TURKSTAT for the period 2010-2015. Regarding, if

urbanization rate is high in a region, keeping number of property constant, it means there is an excess demand and thus, housing prices rise (Öztürk and Fitöz, 2009).

Due to the Figure 5.17 (a), urbanization rates are higher in the central regions of Turkey in 2010. These highest ratios range between 70% and 99%, while some of the pink colored regions have not been urbanized yet.

On the other hand, there are some changes in 2015 (Figure 5.17 (b)). For example, the lowest rate rises from 46.5 to 51.5% and the highest range increases to 94-100%. At this point, TR32 region remarks with shifting from the lowest to the highest ratio.

Therefore, if housing price appreciation rates increased in these dark-red and red colored regions, they might rise because of the urbanization rates.

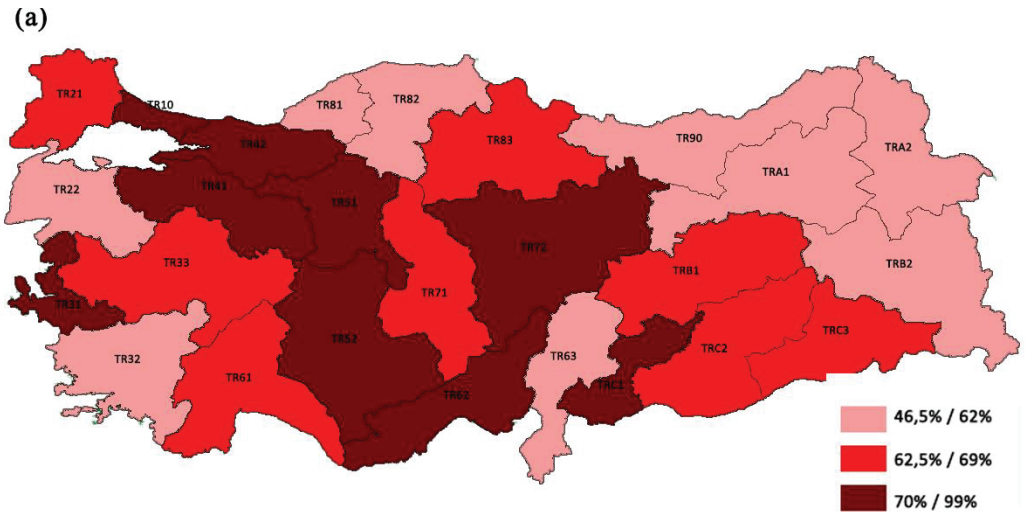

Figure 5.17. Geographical Distribution of Urbanization Rate (%), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

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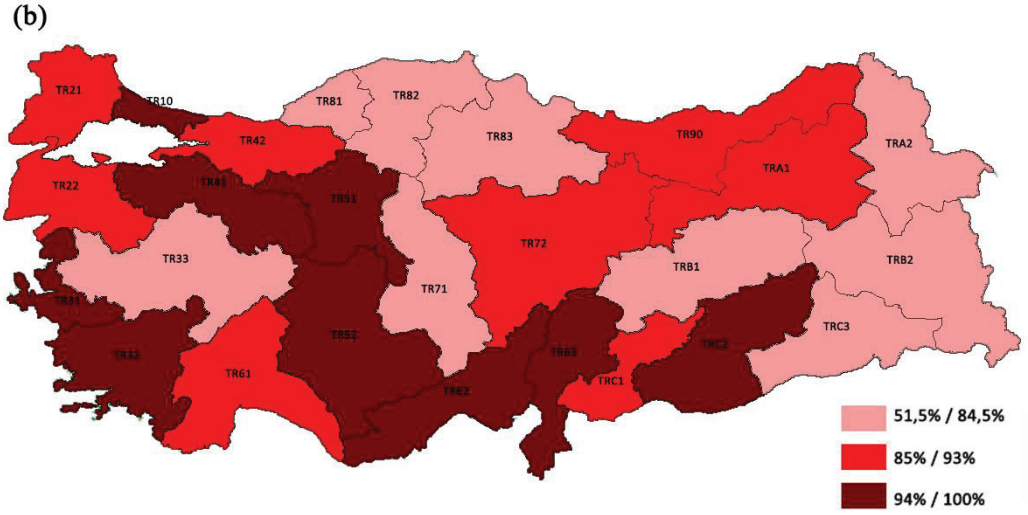

Figure 5.17. (Cont.)

Population density is taken into consideration as a second urbanization variable. This variable differs from population variable by adding surface areas into the account and it refers to number of people per-square kilometer. Although Hirata et al. (2012) and Mamre (2014) found negative relation between housing prices and population density, our expectation is when population density is high in a region, it means there is an excess demand on housing, that's why, this situation results in high housing prices.

In relation, Figure 5.18 (a) illustrates the geographical distribution of population densities in regions. The range of dark red colored regions changes around 101-2.560 person, while it is about 25-70 person in 2010. Again, it can be evidence for inequal distribution of population.

It is expected that over-density regions experiences more housing price appreciation by having great demand on properties in a limited supply area. For this reason, according to the figure, housing prices should be higher in the dark red colored regions.

Comparably, map in 2015 is similar with the map of 2010. However, the highest rage reaches at 2.921 people per square kilometer (Figure 5.18 (b)).

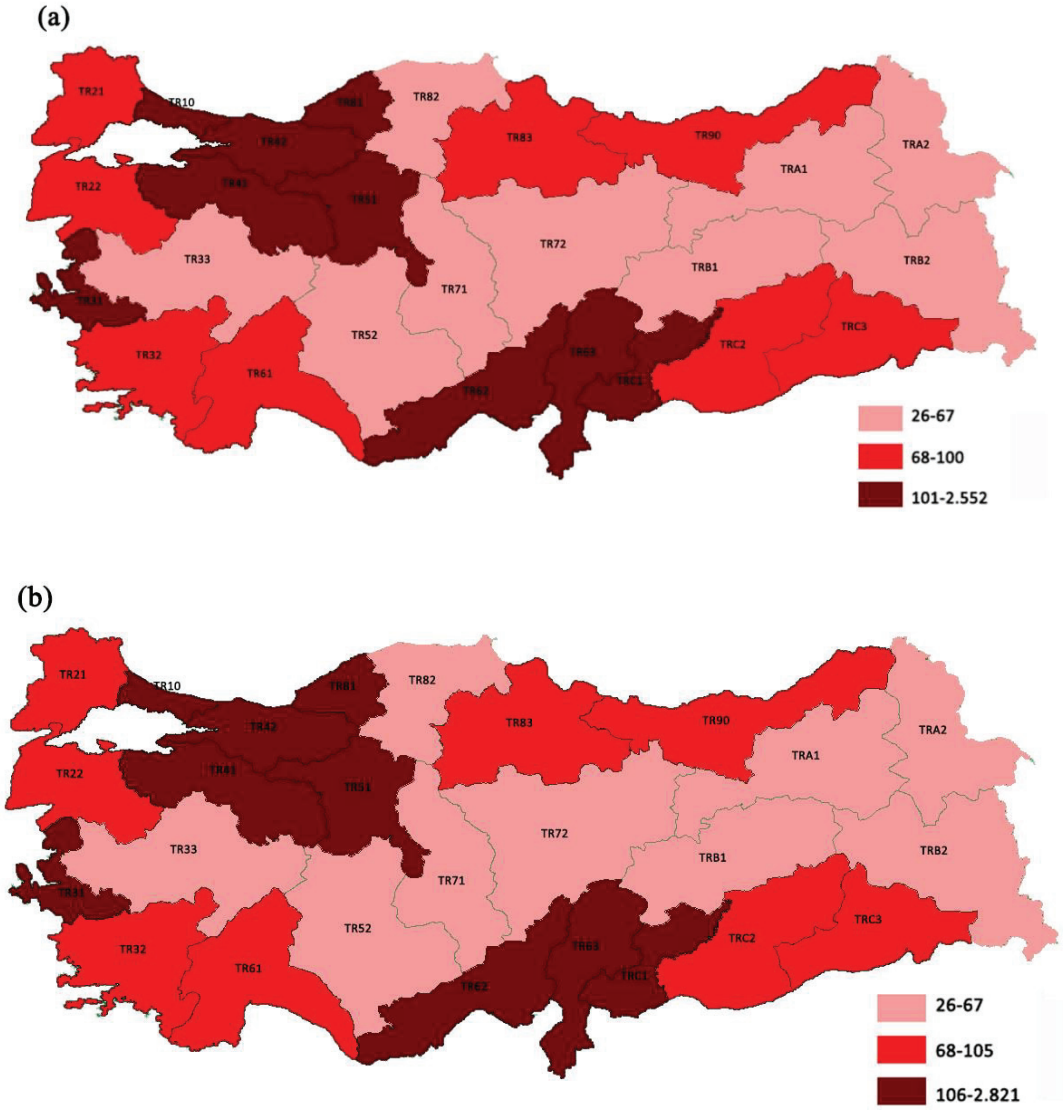

Figure 5.18. Geographical Distribution of Population Density (Person-per km^2), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

Moreover, we think inverse land supply (Conservation area ratio or land availability) as another determinant which restricts housing supply. We use ratio of the conservation areas to total area for determining the extent of housing expansion. It would be more appropriate to add also forest, macquis groves and agricultural areas in this determinant; however, we couldn't reach these data in regional base. The data is obtained from Ministry of Culture and Tourism, Republic of Turkey.

Figure 5.19 indicates conservation area ratio of regions in 2015. Due to the figure, conservation areas dense in southern regions in Turkey and this situation limits

the housing supply. Therefore, if housing prices rise in these dark-colored regions, inverse land supply (Conservation area ratio) might be the underlying cause.

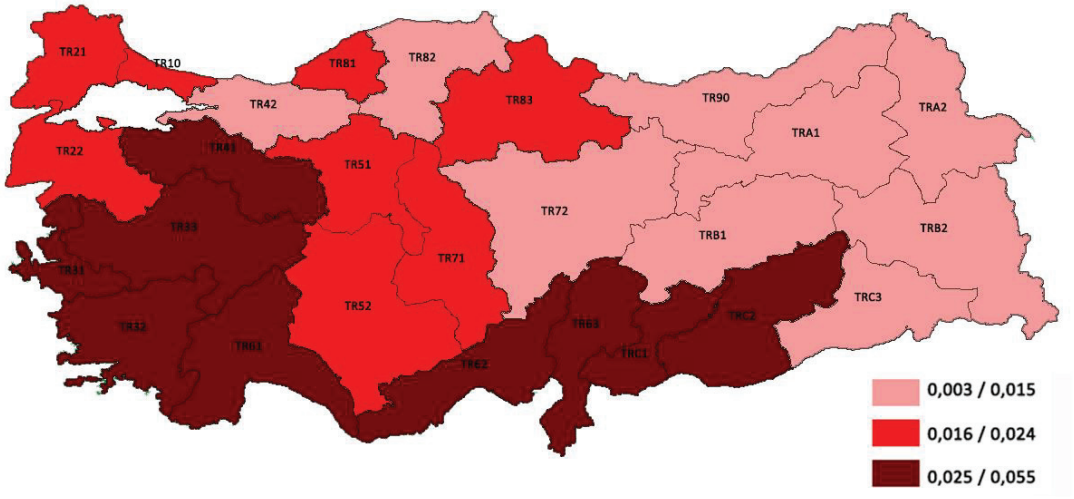

Figure 5.19. Geographical Distribution of Conservation Area Density (Km-per km^2) (Source: Ministry of Culture and Tourism, Republic of Turkey and TURKSTAT, 2016)

Road ratio is another urbanization variable which is calculated by dividing total length of roads to total landscape. Road lengths are acquired by a request from TURKSTAT. In literature, this variable are handled as accessibility such as distance to main roads, CBD, main facilities, sea, bus and metro stations. For instance, Archer, Gatzlaff and Ling (1996), Yankaya and Çelik (2005), Koramaz and Dökmeci (2012) found that housing price appreciation and accessibility work inversely. To contrary, Topçu and Kubat (2009), Kördiş et al. (2014), Yayar and Gül (2014) assert that housing prices rise in associated with accessibility. Our expectation is in the same way with second approach, hence, the hypothesis is if road density is high in a region, it facilitates accessibility and housing prices will be higher. It is needed to note here that this variable concern as road ratio because this study is based on more expanded area than existing micro-level studies. May be, it would be more suitable to add metro, metrobus or train line lenghts to this variable; but, we could not reach the whole exactly.

To extent, according to Figure 5.20 , the highest rates are between 0.47 and 1.36 km to per square kilometer and road densities concentrate on northern, western and southern regions in 2010. Thus, we can think that if housing prices rise these dark red-colored and red-colored regions, they rise due to the road ratio.

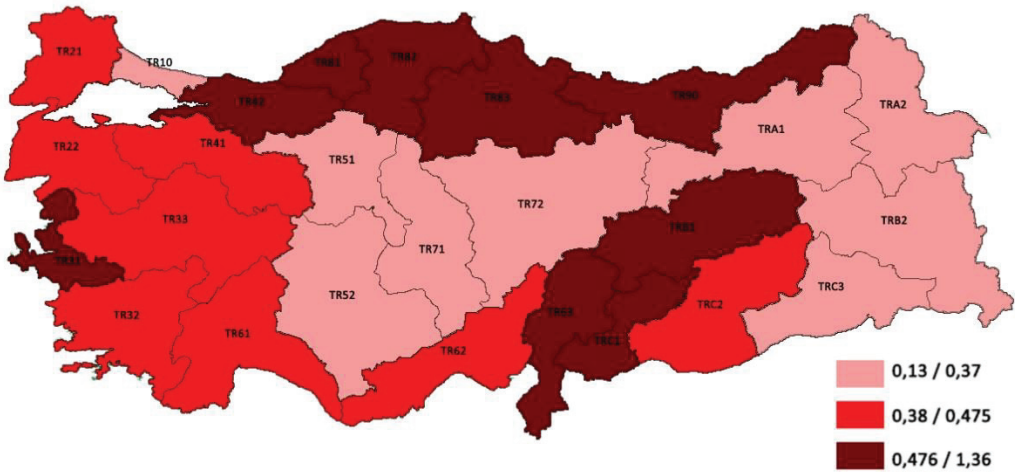

Figure 5.20. Geographical Distribution of Road Density in 2010 (Km-per km^2)
(Source: TURKSTAT, 2017)

Vehicle ratio can also indicate urbanization level and affordability of regions. Because, this variable refers to number of vehicles per capita, obtained by dividing number of vehicle to total population of regions. Our idea is if number of vehicles per-person is great in a region, affordability of regions are also high and thus, housing prices rise.

Considering on vehicle ratio, both maps looks as if it is divided into two as west and east. Due to them, while 0.181-0.35 number of vehicle per capita at western regions, this range is between 0.05-0.18 number of vehicle per capita at eastern regions in 2010 (Figure 5.21(a)). In 2015, the higher range rises to 0.24-0.41 (Figure 5.21(b)). Hereby, housing prices appreciations might depend on vehicle ratio in western regions.

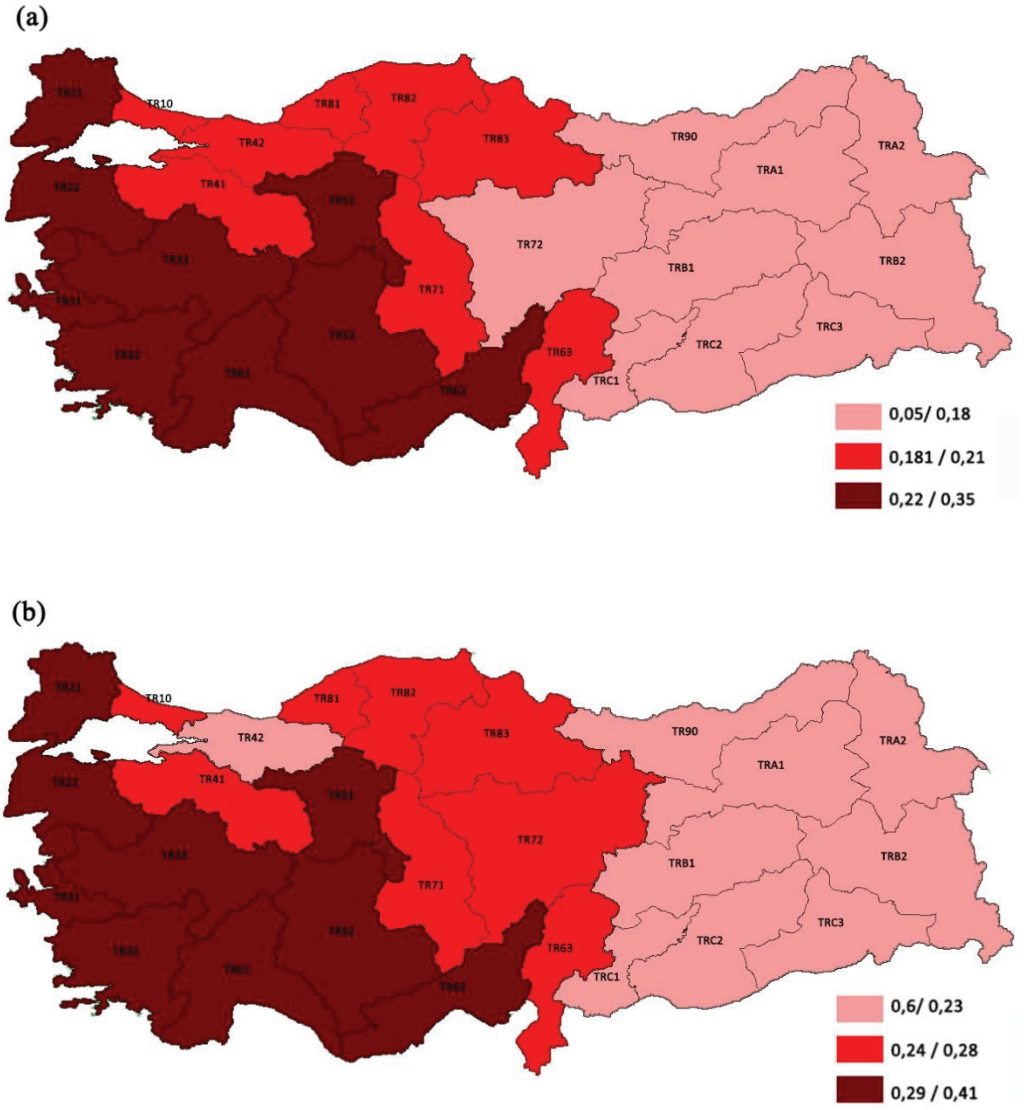

Figure 5.21. Geographical Distribution of Vehicle Ratios (Number of vehicles-per capita), 2010 (a) and 2015 (b) (Source: TURKSTAT; 2016)

As another urbanization variable, health services quaity is concerned. This variable is calculated by dividing number of doctors to total population which are obtained from TURKSTAT. Herein, our opinion is that people might prefer to live close to regions in which conditions of the health sector are good, that situation triggers to demand in these regions. As well as this reason, when new hospitals are opened in a region, housing prices in that area may rise.

It can be inferred from the Figure 5.22 (a) that health services are better in 3 major region TR10, TR31 and TR51. Besides, south-western and north-eastern regions are better in health services. To depth insight, while there are 9-12 doctors per 10.000

people in pink-colored regions, there are 16-34 doctors per 10.000 people in dark red-colored regions in 2010. There are not a distinct change in 2015 (Figure 5.22 (b)). Regardingly, the increases in housing prices in these dark red-colored regions, health services qualities might be the reason.

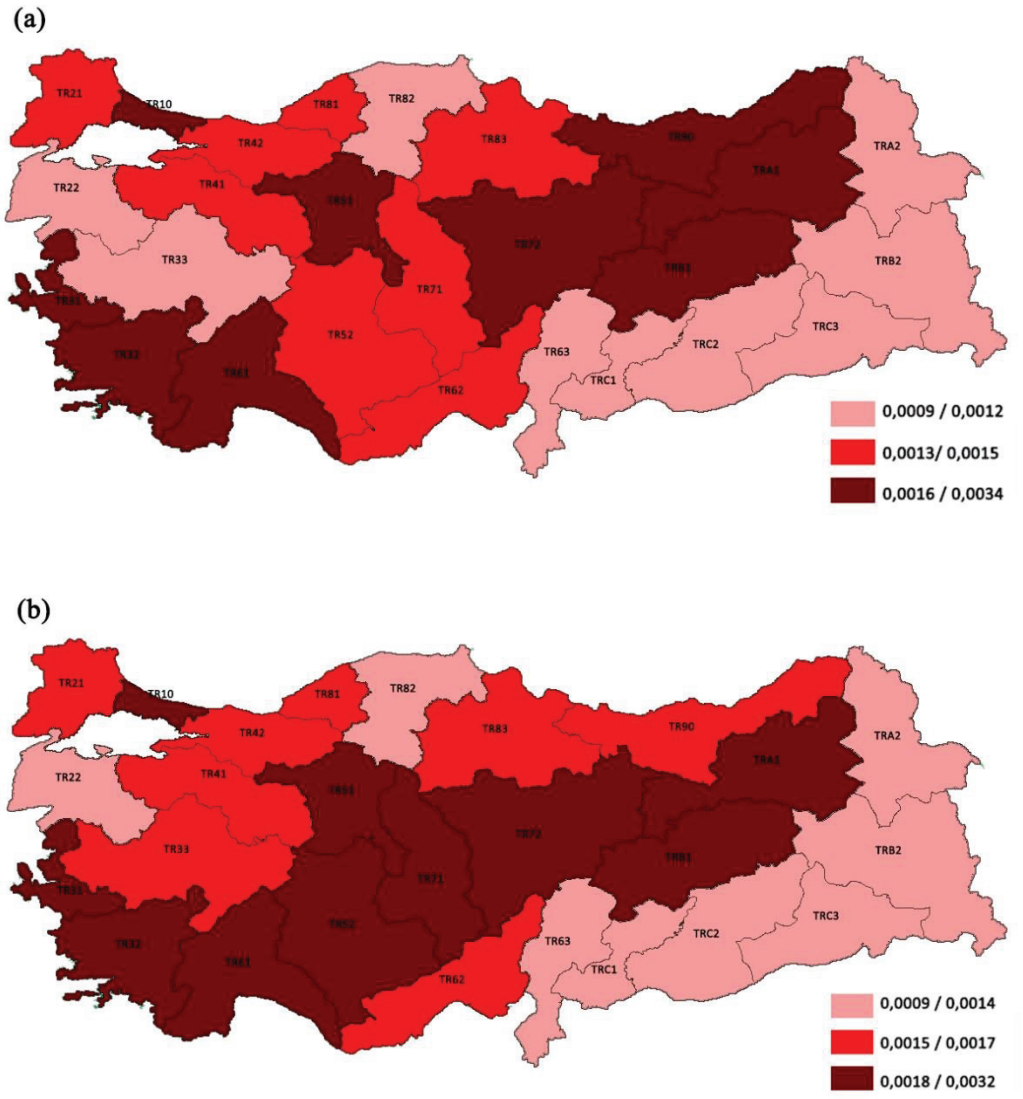

Figure 5.22. Geographical Distribution of Health Services Qualities (Number of doctor-per capita), 2010 (a) and 2015 (b) (Source: TURKSTAT, 2016)

The last variable is the regional crime rate. In our view, housing demand in a region may be affected by crime rates, which suggests that if the crime rates in a region are high, the housing demand will decrease and, consequently, the housing prices will

decrease. It is measured by dividing number of convicted people to total population and both of them acquired with a formal request from TURKSTAT.

Considering this variable, even though the rates are slightly higher, the 2 maps are almost the same. It is seen from the maps that crime rates are falling through west to the east. In this case, it is expected that housing prices will increase through west to east (Figure 5.22).

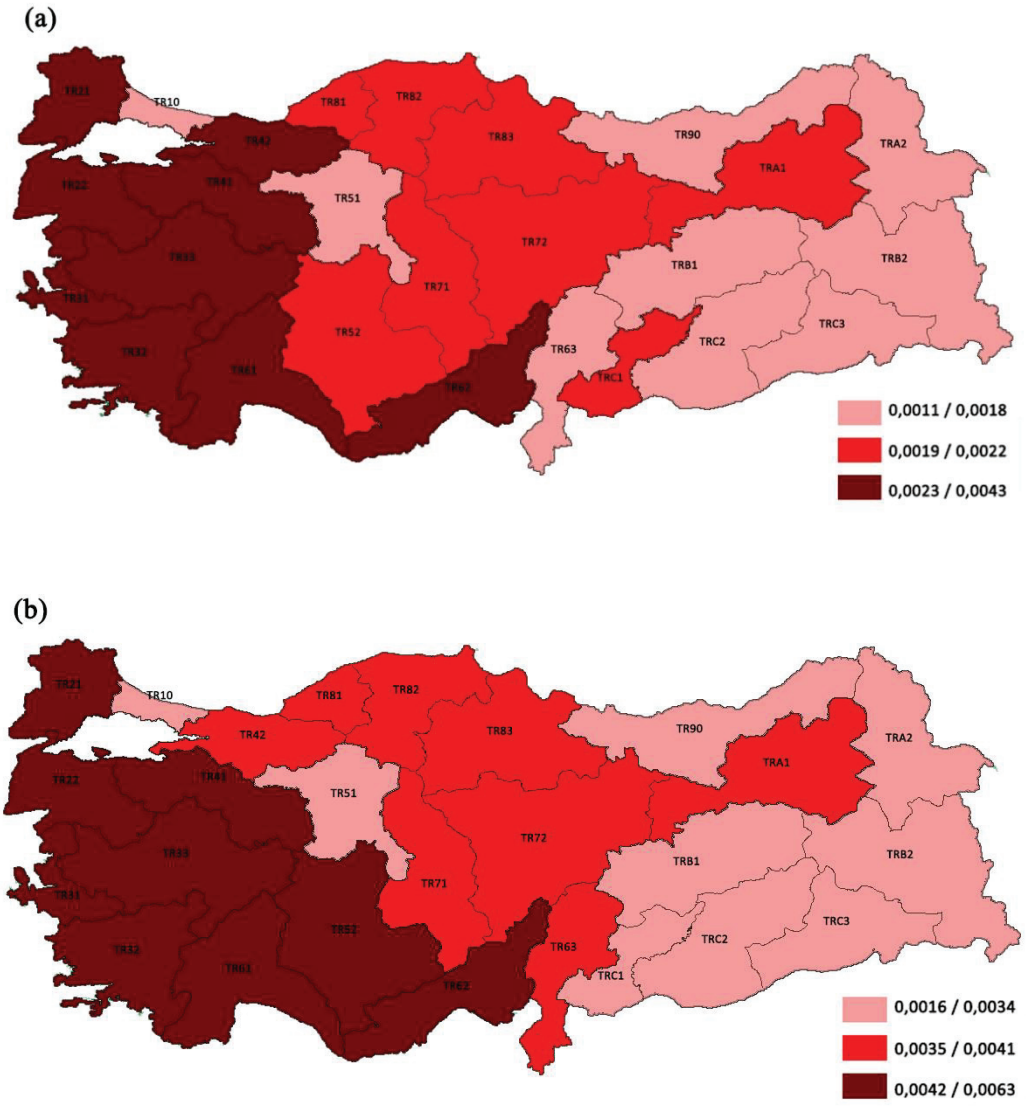

Figure 5.23. Geographical Distribution of Crime Rates (Number of convicted people-per capita), 2010 (a) and 2015 (b) (Source: CBRT, 2016)

5.2.4. Climatic and Geographic Variables

On the issue of housing price determinants geographic and climatic variables are less measured in the literature. Our other purpose is to expand these factors by concerning also the impacts of earthquake risk, seaside ratio, temperature and sunshine duration of the regions. Hereby, the expectation is while higher earthquake risks and conservation area ratios cause a decrease in housing prices across regions, higher seaside ratio, average yearly temperature and sunshine duration of regions affect housing prices positively.

Firstly, earthquake risks of regions ought to be a major part of these variables. Because, Turkey has experienced 2 main earthquakes as Kocaeli and Van earthquakes, which resulted in damaging thousands of people and buildings in the recent past. However, we have attained only a study to consider housing prices and earthquake risk. To illustrate, Keskin (2008) found that housing prices are inversely related with each other, in other words, when earthquake risk rises, housing prices fall.

According to Figure 5.24, earthquake risk areas are defined the range between 1-5 degree by Prime Ministry Disaster and Emergency Management Presidency. Herein, 1 degree refers to highest risk, while 5 degree is the lowest. However, these areas are indicated in urban-scale, for this study, we convert them to NUTS 2 level by calculating the arithmetic mean of the risk degrees of cities. So, Figure 5.16 demonstrates the earthquake risk map of regions. Consequently, regions, located in western and eastern parts of Turkey and north-west part of Anatolian seem to be in the 1 degree earthquake risk zone. The region-based data can be thought of as being somewhat broad for this variable; but, the effects of this disaster can be so extensive. If there is tendency to decline in housing prices at dark red colored regions, it might depend on the degree of earthquake risk.

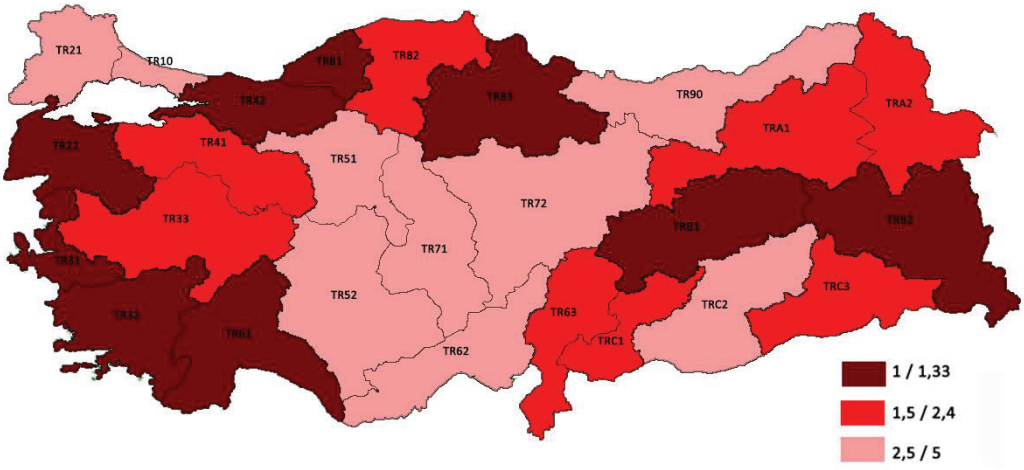

Figure 5.24. Geographical Distribution of Earthquake Risks (1-5 degrees of risk) (Source: Prime Ministry Disaster and Emergency Management Presidency, 2016)

Seaside ratio is an over-impressing determinant on housing prices in concert with the investments on tourism. Seaside attracts to investments for residential and touristic areas, that's why, regions which have longer seaside is expected to have higher housing prices. Seaside lengths are obtained by measuring from Google Earth and also from the Ministry of Culture and Tourism of Turkey. At last, seaside densities are calculated by dividing length to total surface area of each region.

In Figure 5.25, pink colored regions do not have coast to sea, only 14 regions (dark red and red colored) have in Turkey. Among them, TR10, TR42 regions in northern, TR22, TR31, TR32 regions in western, and TR61, TR62 regions in southern part of Turkey have longer coasts. Hence, high housing prices in these regions may be due to seaside ratios.

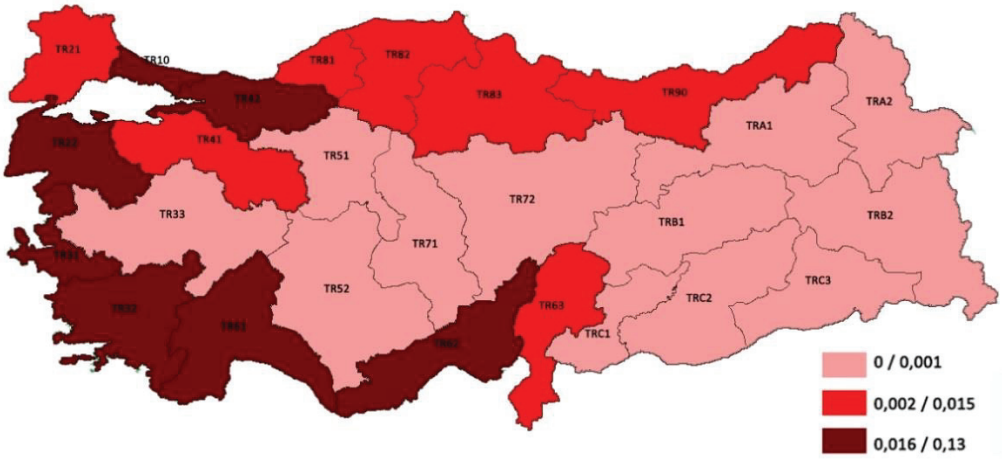

Figure 5.25. Geographical Distribution of Seaside Ratios (Km-per km^2)
(Source: TURKSTAT and Own Calculations (for shore length), 2016)

The next examined determinant is average yearly temperature that we haven't met in literature. The data is measured by averaging temperature of the cities in the region and averaging period between 1950-2015 which are published by the Turkish Ministry of Forestry and Water Affairs, General Directorate of Meteorology (This is a time invariant variable).

Therefore, the hypothesis is that housing prices are expected in regions which have higher temperatures. Because people might intend warmer areas to live, so this increases to housing demand in these areas. Due to the Figure 5.26, while the western and southern regions of Turkey are between 14 and 19 ° C, the average annual temperature in the coldest regions decreases to 6.5 ° C. As a result, if red and dark red colored regions have higher prices, it might be the effect of average yearly temperature.

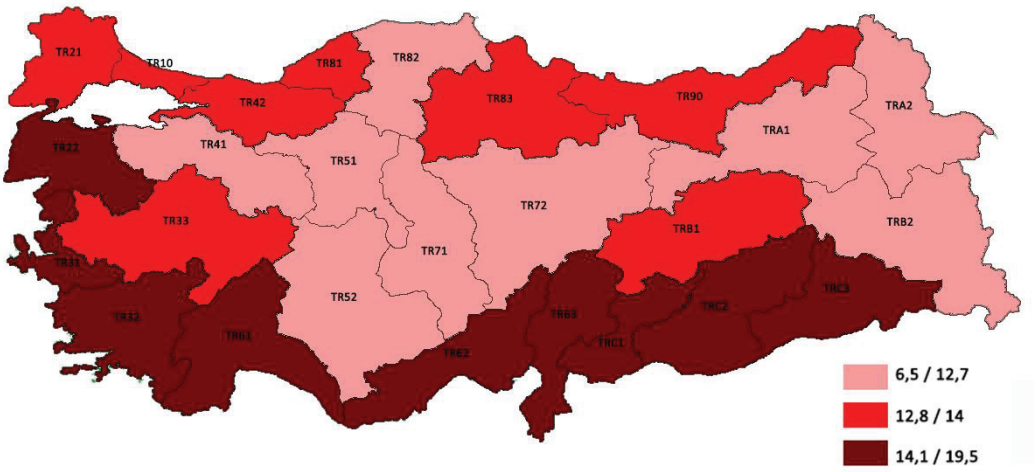

Figure 5.26. Geographical Distribution of Average Yearly Temperatures (°C), 1950-2015 (Source: Turkish Ministry of Forestry and Water Affairs, General Directorate of Meteorology, 2016)

For the last climatic variable, regional sunshine durations are examined. Herein, the hypothesis is people might prone to live in warmer regions in order to benefit from the sun by far. Average Durations of Sun (hours) per day are acquired in city level from General Directorate of Meteorology, and transformed to region level by averaging.

Dealing with this variable, it can be inferred from the Figure 5.27 that regional sunshine durations decrease the northern through the southern regions. By extension, if housing upward price movements are higher in southern than northern regions, they might be influenced by the duration of sunshine.

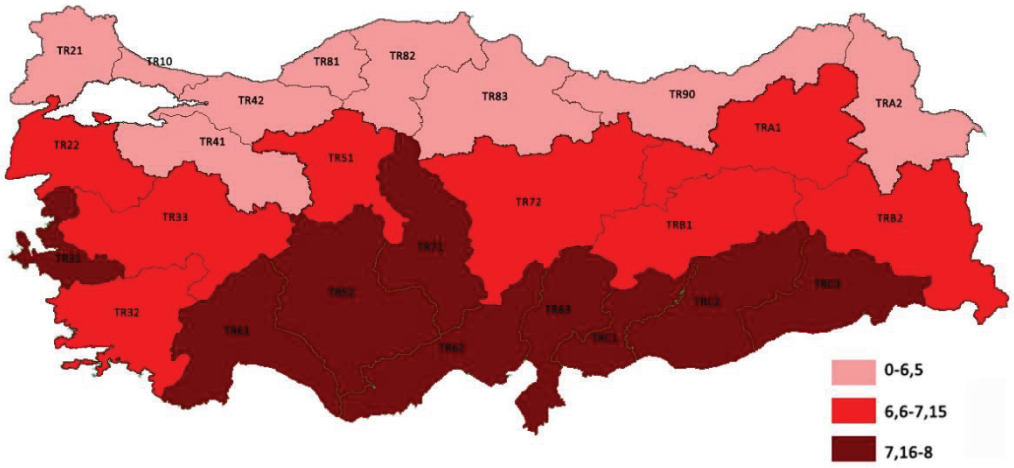

Figure 5.27. Geographical Distribution of Sunshine Durations (Average hours-per day) (Source: General Directorate of Meteorology, Republic of Turkey, 2016)

5.2.5. Cultural Variables

People might prefer to live close to cultural facilities as cinema, theater and libraries. Cultural activity ratio is considered for determining housing price appreciations. This variable has not dealt in literature to our knowledge. It is calculated by dividing the number of people participated in cinema, theater and libraries to total population which are obtained separately from TURKSTAT. In relation to this variable, the hypothesis is in places where participation rates are higher, experience higher housing price appreciation.

According to Figure 5.28, participations to the cultural activities intensify at the central regions. In 2010, the highest participation range to cultural activities between 0.86 and 1.21 per capita, while it changes in 1.11-1.74 in 2015. If these red-colored regions have more housing price appreciation, cultural activity ratios might be a trigger.

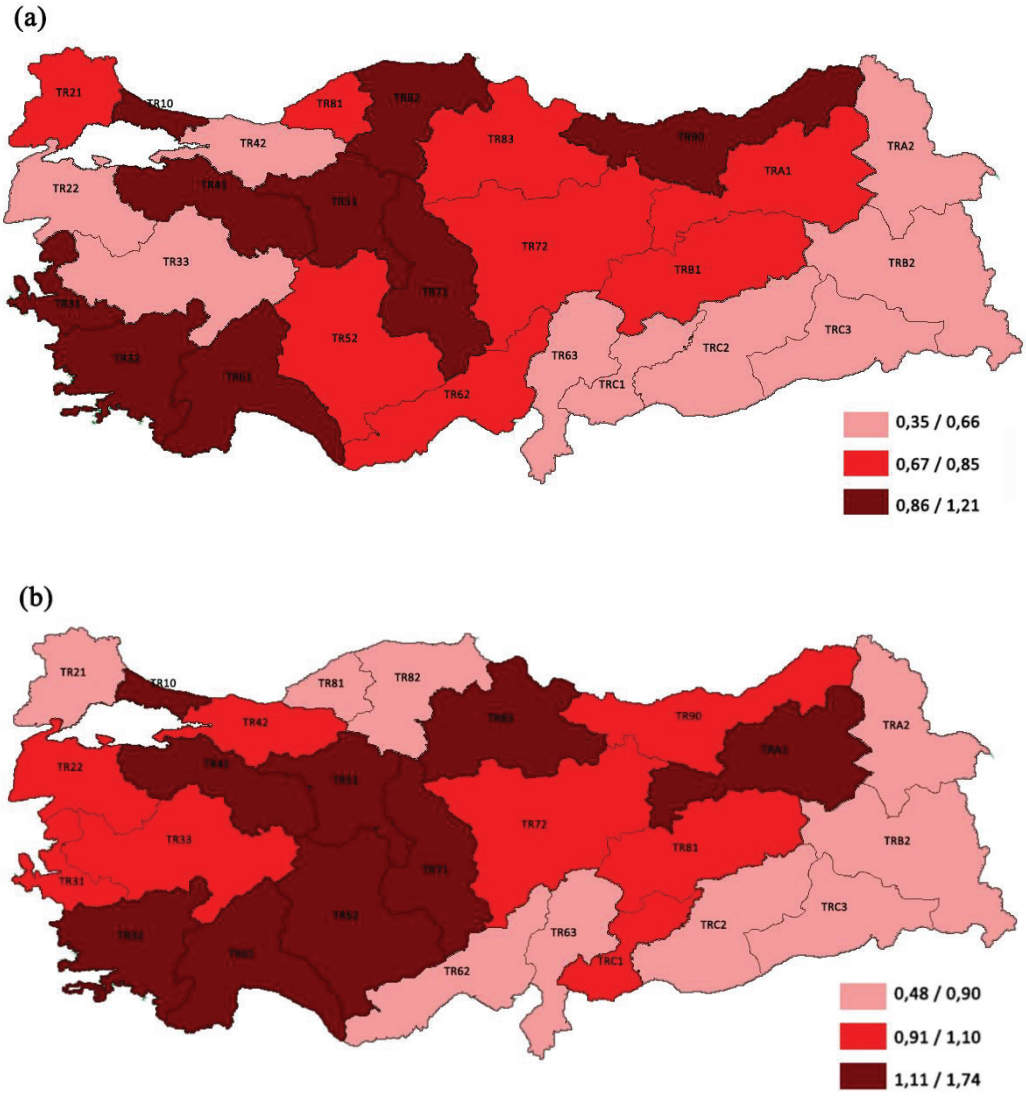

Figure 5.28. Geographical Distribution of Cultural Activity Ratios, 2010 (a) and 2015 (b) (Source: CBRT, 2016)

5.2. Macroeconomic Determinants of Regional Housing Prices: Time Series Analysis

Our first major goal is to understand impact values of fundamental and speculative determinants on housing price appreciation. To extent, the second part of the analysis is based on the macroeconomic determinants.

In relation, we pursue a time series (PVAR) analysis on the regional housing market by controlling also the impact of macroeconomic determinants on the regional housing prices. We use monthly data in current part. In terms of adopted variables, we

use 2 regional variables (each for 26 regions) and 6 aggregate variables. The definition of variables is summarized in the table below.

Table 5.2. Definition of Macroeconomic Variables

Variable	Definition	Period	Spatial Units	Source
HPI	Housing price index	2010:1-2016:9	For 26 regions	CBRT
CPI	Consumer price index	2010:1-2016:9	For 26 regions	CBRT
CCI	Consumer confidence index	2010:1-2016:9	Aggregate variable	TURKSTAT
CONSCOST	Building construction cost index	2010:1-2016:9	Aggregate variable	TURKSTAT
EMP	Employment	2010:1-2016:9	Aggregate variable	TURKSTAT
INT	Weighted mean of housing interest rate given by banks	2010:1-2016:9	Aggregate variable	CBRT
M2	Money supply (M2)	2010:1-2016:9	Aggregate variable	CBRT
PERMIS	Permissions given to the construction of all buildings (m^2)	2010:1-2016:9	Aggregate variable	TURKSTAT

All our variables are seasonally adjusted by using the multiplicative ratio to moving average technique.[2] An initial step in our analysis is to understand the time series properties of our variables. To do so, we implement a Unit Root Analysis by applying an Augmented Dickey Fuller Test to all our series. The results are presented in tables below. It has been shown that almost all our series follow a non-stationary process since the ADF statistics is not significant. Only consumer confidence and construction permissions variables are found to be stationary.

Hence, in order to proceed with our analysis, we calculate the percentage increase in series (at the annual rate) from 2011:1-2016:9 and make our series stationary in this way.

[2] The empirical analyses are implemented in Eviews and R Softwares ("Spdep" and "Splm" packages).

Table 5.3. Unit Root Analysis, ADF Test

Variable	ADF Statistic	Lag Order	Result
CCI	-2,706200*	0	I(0)-Stationary
CONSCOST	-0,837936	3	I(1)-Nonstationary
EMP	-1,365249	3	I(1)-Nonstationary
INT	-2,368509	1	I(1)-Nonstationary
M2	1,974518	0	I(1)-Nonstationary
PERMIS	-3,867858***	1	I(0)-Stationary

Note: *** denotes significance at 1 %, ** at 5 %, *** at 10 %. Maximum lag order of 24 months has been applied by using a Schwarz criterion

Table 5.3. (Cont.)

Variable	ADF Statistic	Lag Order	Result
HPI_TR10	8,4050	0	I(1)-Nonstationary
HPI_TR21	8,836503	0	I(1)-Nonstationary
HPI_TR22	4,257675	3	I(1)-Nonstationary
HPI_TR31	5,898646	2	I(1)-Nonstationary
HPI_TR32	4,336316	0	I(1)-Nonstationary
HPI_TR33	1,894531	3	I(1)-Nonstationary
HPI_TR41	8,426178	0	I(1)-Nonstationary
HPI_TR42	6,565904	0	I(1)-Nonstationary
HPI_TR51	4,260455	0	I(1)-Nonstationary
HPI_TR52	1,419094	0	I(1)-Nonstationary
HPI_TR61	2,078711	2	I(1)-Nonstationary
HPI_TR62	5,59266	3	I(1)-Nonstationary
HPI_TR63	1,35893	3	I(1)-Nonstationary
HPI_TR71	-0,201033	0	I(1)-Nonstationary
HPI_TR72	0,939227	0	I(1)-Nonstationary
HPI_TR81	-0,159724	0	I(1)-Nonstationary
HPI_TR82	-0,205654	6	I(1)-Nonstationary
HPI_TR83	3,169398	0	I(1)-Nonstationary
HPI_TR90	4,273335	4	I(1)-Nonstationary
HPI_TRA1	-1,305085	3	I(1)-Nonstationary
HPI_TRA2	-0,69993	0	I(1)-Nonstationary

Note: *** denotes significance at 1 %, ** at 5 %, *** at 10 %. Maximum lag order of 24 months has been applied by using a Schwarz criterion

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Table 5.3. (Cont.)

Variable	ADF Statistic	Lag Order	Result
HPI_TRB1	1,73409	3	I(1)-Nonstationary
HPI_TRB2	-1,026691	0	I(1)-Nonstationary
HPI_TRC1	-2,080272	0	I(1)-Nonstationary
HPI_TRC2	-1,761688	0	I(1)-Nonstationary
HPI_TRC3	0,173087	3	I(1)-Nonstationary

Note: *** denotes significance at 1 %, ** at 5 %, *** at 10 %. Maximum lag order of 24 months has been applied by using a Schwarz criterion.

Table 5.3. (Cont.)

Variable	ADF Statistic	Lag Order	Result
CPI_TR10	1,938392	0	I(1)-Nonstationary
CPI_TR21	1,523816	2	I(1)-Nonstationary
CPI_TR22	2,0245	2	I(1)-Nonstationary
CPI_TR31	2,318752	2	I(1)-Nonstationary
CPI_TR32	2,132288	2	I(1)-Nonstationary
CPI_TR33	2,996307	7	I(1)-Nonstationary
CPI_TR41	1,971474	0	I(1)-Nonstationary
CPI_TR42	2,05051	2	I(1)-Nonstationary
CPI_TR51	1,956992	0	I(1)-Nonstationary
CPI_TR52	1,865587	7	I(1)-Nonstationary
CPI_TR61	2,004471	2	I(1)-Nonstationary
CPI_TR62	2,234742	2	I(1)-Nonstationary
CPI_TR63	1,229433	2	I(1)-Nonstationary
CPI_TR71	0,712736	0	I(1)-Nonstationary
CPI_TR72	1,749918	7	I(1)-Nonstationary
CPI_TR81	1,169327	0	I(1)-Nonstationary
CPI_TR82	1,277267	2	I(1)-Nonstationary
CPI_TR83	1,786788	3	I(1)-Nonstationary
CPI_TR90	1,721772	3	I(1)-Nonstationary
CPI_TRA1	0,281496	0	I(1)-Nonstationary
CPI_TRA2	1,787185	3	I(1)-Nonstationary
CPI_TRB1	1,006637	0	I(1)-Nonstationary
CPI_TRB2	1,352158	2	I(1)-Nonstationary
CPI_TRC1	1,782493	3	I(1)-Nonstationary
CPI_TRC2	2,076084	3	I(1)-Nonstationary
CPI_TRC3	1,637475	3	I(1)-Nonstationary

Note: *** denotes significance at 1 %, ** at 5 %, *** at 10 %. Maximum lag order of 24 months has been applied by using a Schwarz criterion.

In order to estimate the effect of speculative and fundamental variables, we employ a Panel Vector Auto-Regression Model (PVAR) in equation (5.1). It covers a dataset that includes 26 regions and 68 months (from 2011:1 to 2016:9). In total, there are 26x68 (1768) observations.

$$x_{i,t} = c + \sum_{j=1}^{J} A_j \, x_{i,t-j} + \vartheta_{i,t}$$

$$x_{i,t} = \left\{\Delta cci_t, \Delta emp_{t,} \Delta cpi_{i,t}, \Delta conscost_t, \Delta permis_t, \Delta m2_t, \Delta int_{t,} \Delta hpi_{i,t}\right\} \quad (5.1)$$

Where i represents the regions, t denotes months and x represents a set of endogenous variables which are already defined in Table 5.2. All aggregate and region specific variables are used in a form of percentage change (at the annual rate) in order to ensure the stationary property. The lag length has been determined by using a Schwarz (1978) Criterion.

The first result obtained from the estimation is related to Cholesky Forecast Error Variance Decomposition of housing price indexes. It specifically shows the percentage of regional housing price movements due to different variables.

The outcome is shown in Figure 5.29 from which we note several important results. First, it clearly shows the importance of speculative movements that about 40% of the changes in housing prices are due to the former changes in housing prices (HPI). This variable represents the backward-speculative component. Second, in terms of forward-looking speculation, only about 0-5% of the changes in housing prices is attributed to changes in CCI (Consumer confidence index). Third, among the fundamental variables, the following ones have respectively higher impact on the property price dynamics: construction permissions (17-18%), housing interest rate (15%), regional consumer price inflation (12%), employment rate (10%), construction cost (2-3%) and money supply (2-3%).

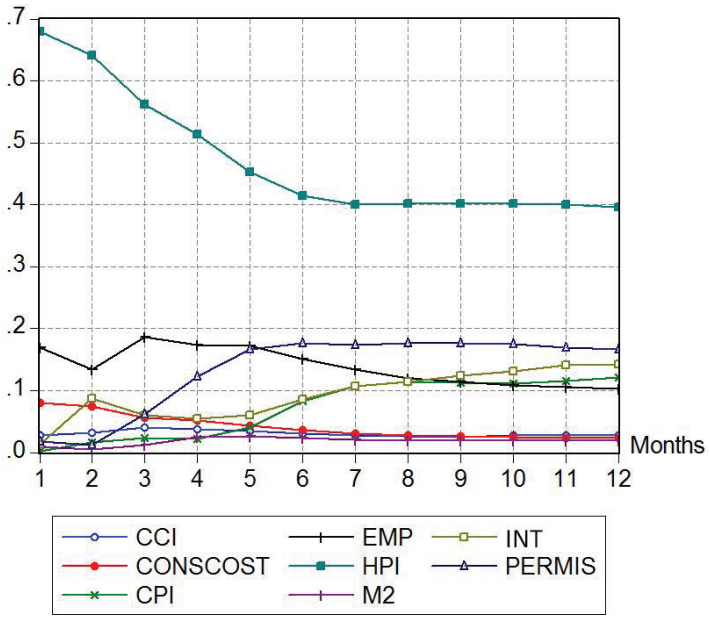

Figure 5.29. Cholesky Forecast Error Variance Decomposition of Regional Housing Price Increases, 12 Months Horizon

To be able to provide more insights on how fundamental variables affect the housing prices, we calculate the Impulse-Response Functions for each endogenous variable. These functions show how housing prices respond to a change in macro-variable. The results are shown in below graphics (Figure 5.30):

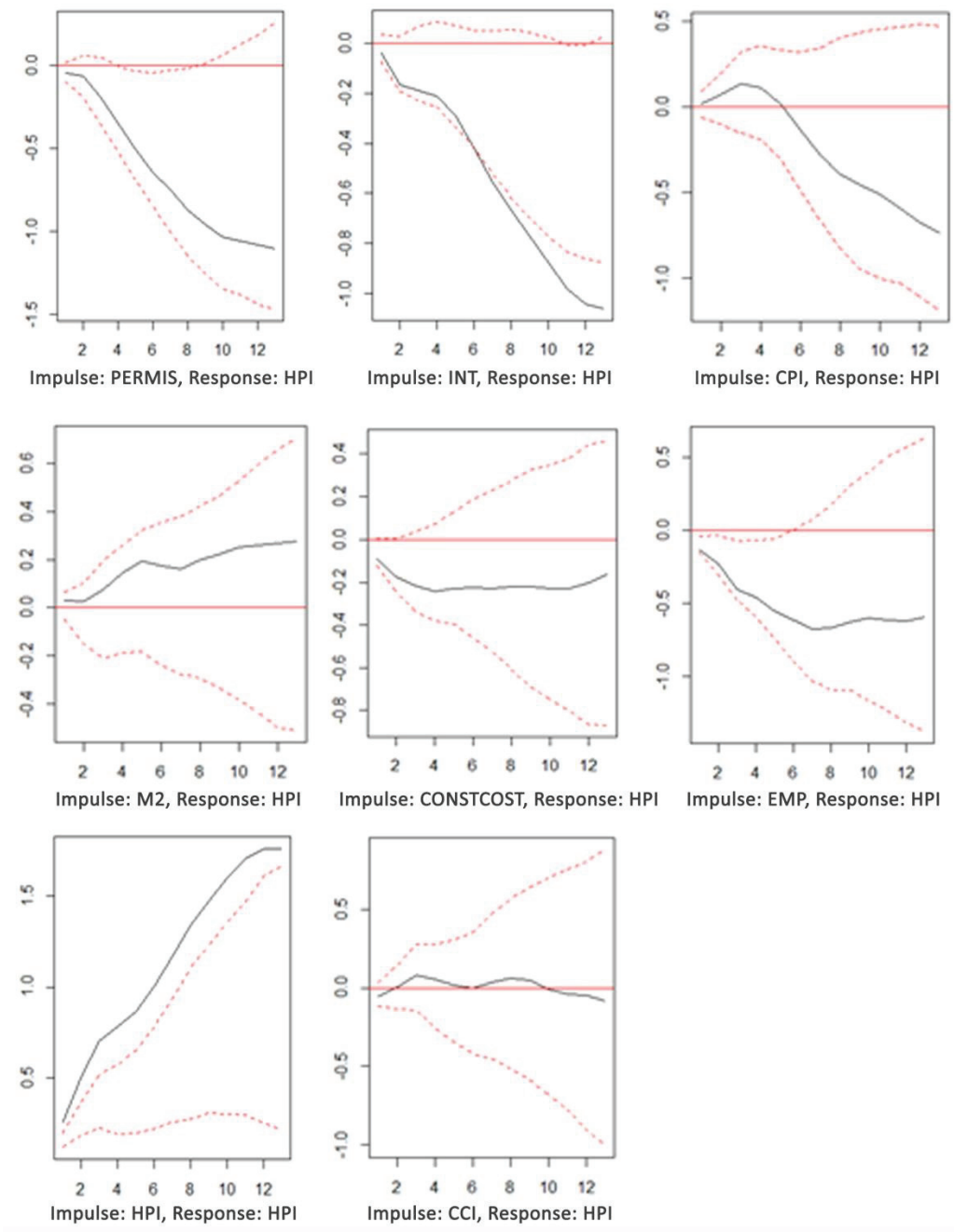

Figure 5.30. Impulse-Response Functions, Impulse: Macroeconomic Variables, Response: Regional Housing Prices

As observed, the most influential variable is the construction permissions variable that has a negative impact on the prices as more permissions increase the housing supply that causes prices to decline. Second, an increase in interest rate clearly decreases the housing prices. Third, acceleration in inflation causes a decline in housing

prices since it lowers purchasing power of individuals. The other variables are either weakly or not important in explaining the regional housing prices.

Moreover, as another analysis in current section, we concentrate more on speculative behavior of regions. We estimate the model in Equation (5.1) for each (26) region and calculate the forecast error variance decompositions due to backward (HPI's past values) and forward speculation variable (CCI). This analysis gives that how much housing upward movement results in fundamental and speculative variables. In order to constitute in depth insight, it provides the relative impacts of backward and forward-looking expectation separately. Table 5.4 summarizes the results below.

Table 5.4. Cholesky Forecast Error Variance Decomposition of Housing Prices, 12 Months Horizon

Regions	Forward-Looking Expectations(CCI)	Backward-Looking Expectations (HPI)	Fundamental Variables
TR10	7.96%	38.23%	53.81%
TR21	3.82%	29.06%	67.11%
TR22	6.64%	39.00%	54.37%
TR31	5.58%	37.73%	56.69%
TR32	5.94%	31.51%	62.55%
TR33	19.06%	21.38%	59.57%
TR41	2.53%	44.64%	52.83%
TR42	4.31%	32.11%	63.58%
TR51	13.48%	3.60%	82.92%
TR52	17.13%	34.77%	48.10%
TR61	1.39%	16.77%	81.84%
TR62	14.50%	12.27%	73.23%
TR63	1.51%	10.23%	88.26%
TR71	3.52%	35.84%	60.64%
TR72	7.07%	43.32%	49.60%
TR81	5.39%	51.00%	43.62%
TR82	5.39%	43.42%	51.19%
TR83	6.70%	24.84%	68.46%
TR90	5.42%	26.13%	68.46%
TRA1	4.40%	54.99%	40.61%
TRA2	4.26%	25.58%	70.16%

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Table 5.4. (Cont.)

Regions	Forward-Looking Expectations(CCI)	Backward-Looking Expectations (HPI)	Fundamental Variables
TRB1	16.07%	57.01%	26.92%
TRB2	6.93%	23.57%	69.51%
TRC1	22.57%	5.08%	72.36%
TRC2	10.94%	11.80%	77.26%
TRC3	5.78%	36.38%	57.84%
Mean	**8.01%**	**30.39%**	**61.60%**
Max	**22.57%**	**57.01%**	**88.26%**
Min	**1.39%**	**3.6%**	**26.92%**
SD	**5.65%**	**14.67%**	**14.10%**

At a glance, backward speculation's role ranges between 57% and 3.6% among regions. Forward speculation's role ranges between 1.3% and 22.5% and fundamental variables' role ranges between 27% and 88%. On average, backward speculation accounts for about 30%, forward speculation accounts for about 8% and fundamental variables account for about 62% of the changes in regional housing prices.

At last, we visualized the results mentioned above and prepared two separate maps showing the geographical distribution of the impact values of the fundamental and speculative variables in order to understand which of them are more effective in which regions. Then, we prepared 2 more visuals on the geographical distribution of speculative variables as forward and backward-looking expectations for the period 2010-2016 to determine whichever region remains at the forefront.

In relation to that between about 68.5-88.3% of housing price appreciations arise from fundamental determinants in dark red colored regions, surrounding the north-eastern, eastern and southern edges of Turkey, and TR51 region (Figure 5.31). It means the roles of speculation in that regions are less. To contrary, impacts of fundamental variables changes between about 27-54.5% in the pink colored regions. The impact values of speculation in these regions seem to be either equal to the role of fundamental factors or more effective.

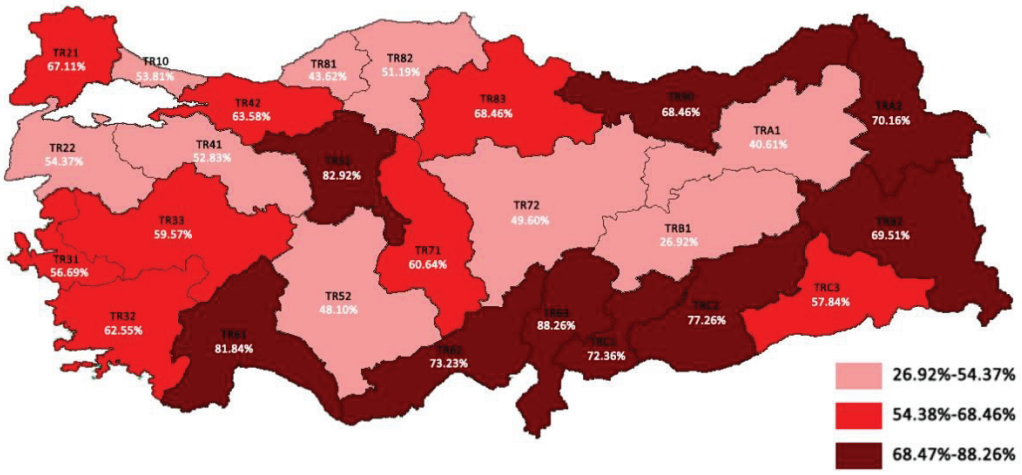

Figure 5.31. Geographical Distribution of Impact Values of Fundamental Variables (%)

The map on impacts of speculative determinants is totally opposite of the map above. Herein, about 43.5-73% of the housing price increases are related to the speculative factors in dark red colored regions. So, the remaining effect is due to the fundamental factors. However, in pink colored regions this rate falls between about 12-31.5%, in other words, even in the region which experiences the lowest speculation effect, at least 12% of housing price increase is due to speculation (Figure 5.32).

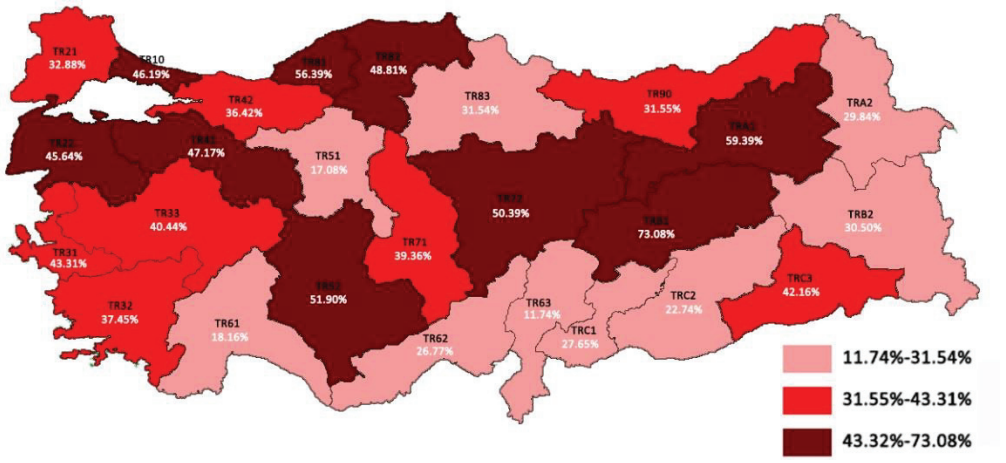

Figure 5.32. Geographical Distribution of Impact Values of Speculative Variables (%)

In addition, it is necessary to examine speculative factors in more detail, according to Figure 5.33, in dark red regions, the impact of speculation about 36-57% were found to be associated with the backward looking expectations. But, this range is between about 3-25% in pink colored regions. More specifically, all of the housing price increases are related to the valuation of housing prices in the past. However, the degree of influence varies between regions.

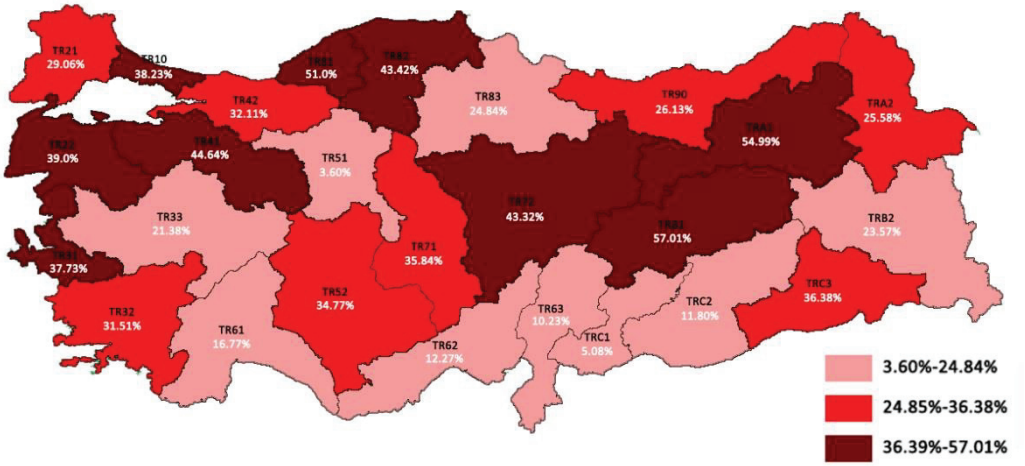

Figure 5.33. Geographical Distribution of Impact Values of Backward-Looking Expectations (%)

On the other hand, impact level of forward looking expectation reaches at about 22,5% in some regions. This indicates that consumer confidence index (CCI) is higher and people have more tendencies to make savings and housing investment in these regions. Besides, approximately 1.5-6.5% of the speculation is related to forward looking expectations in the lowest range, while it varies between 7-22.5% at the highest level (Figure 5.34).

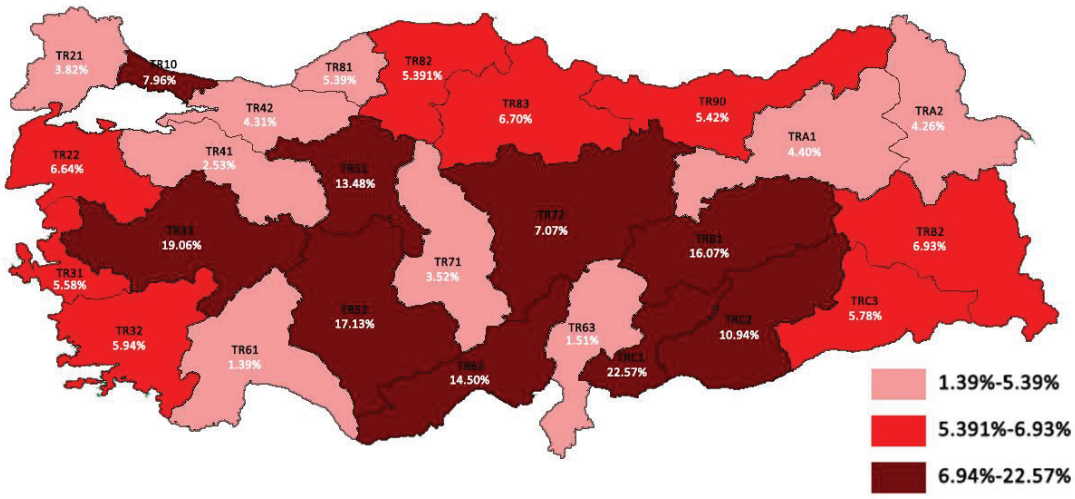

Figure 5.34. Geographical Distribution of Impact Values of Forward-Looking Expectations (%)

Overall, the lesson we get from this section is that, first, speculation is an unignorably important behavior in Turkish real estate markets that is approximately responsible for about 40% of the housing price movements. Second, interest rates, construction permissions and regional inflation rates are the important fundamental variables which have a detrimental impact on housing price appreciations.

5.3. Regional Determinants of Housing Prices: Cross-Sectional Analysis

The second major goal is to find out the reasons behind the regional disparities in terms of upward house price movements. Therefore, this section includes the implementation of a cross sectional analysis. To do so, we employ the following panel data regression that incorporates a large set of variables:

$$\Delta hpi_{i,t} = \gamma + \rho\Delta hpi_{i,t-1} + \delta E_{i,t-1} + \theta D_{i,t-1} + \varphi U_{i,t-1} + \partial CL_{it-1} + \omega CU_{i,t-1} + d_{1i,t}Reg + d_{2i,t}Years + \epsilon_{i,t}$$

$$i=1,.....,26 \ , \ t=2011,.....,2015 \qquad (5.2)$$

There are 130 observations in this model. The dependent variable, Δhpi, represents the annual percentage increase in regional housing price indexes. The first independent variable is the lagged value of the dependent variable. So, ρ captures the degree of backward speculation behavior. *E* represents the group of economic variables, *D* denotes demographic variables, *U* includes the variables related to urbanization, *CL* represents the climatic and geographic variables and *CU* represents cultural variables. All these determinants are region specific variables. These groups contain the fundamental variables which are mostly the demand-side and to a less extent the supply side variables. d1 and d2 represent respectively the regional and time specific dummies.[3] $\epsilon_{i,t}$ represents the residuals that are assumed to follow an identical and independent distribution with zero mean and constant variance. The full documentation of variables, their definition and other details are documented in Table 5.5.

We estimate the model in equation (5.2) by using a Least Squares Dummy Variable (LSDV) Method and control in this way the impact of possible time and region specific fixed effects. One year lagged version of independent variables are used so to avoid the simultaneity problem.

To be able to follow an appropriate empirical strategy, we first define a base model that includes control variables which are the most frequently referred variables in the literature. These are population, employment, inverse land supply, inflation and lagged value of the HPI variables. All these variables are uncorrelated with each other.

Afterwards, other independent variables are added to the base model one-by-one. Hence, in total 20 models are created. Each model includes control variables and a different independent variable of interest. In order to avoid multi-collinearity, when an independent variable is correlated with one of the control variables (when Pearson

[3] Regional dummies are created by adding dummy variables for 7 geographical regions in Turkey. Time fixed effects are controlled by adding time dummies for 2013, 2014, 2015 years.

correlation coefficient >0.2), that control variable is discarded only for the estimation of that specific model. The results are summarized in Table 5.6.

Table 5.5. Definition of Regional Independent Variables

Groups	Variable Name	Definition	Side	Source
E (Economic Variables)	Employment	Regional employment rates (For +15 years old)	Demand	TURKSTAT
	Inflation	Regional inflation rates	Demand and Supply	CBRT
	Trade Openness	Trade openness of the region (Export+ import volume)/population	Demand	TURKSTAT
	Labor Participation Rate	Active population (15-64 years old)/total population	Demand	TURKSTAT
D (Demographic variables)	Population	Population	Demand	TURKSTAT
	Net Migration Rate	Net migration rate	Demand	TURKSTAT
	Student Ratio	Number of university students/population	Demand	TURKSTAT
	Student-Teacher Ratio (Education Quality)	Number of students/number of teachers	Demand	TURKSTAT
	Bachelor Rate	Number of people having a university diploma/population	Demand	TURKSTAT
	Age Dependency	Number of people (Between 0-14 or above 64 years) who must be looked after by a person (15-64 years)	Demand	TURKSTAT
	Household Size	Number of person per-household	Demand	TURKSTAT
U (Urbanization variables)	Urbanization Rate	Percentage of people living in urban areas	Demand	TURKSTAT
	Population Density	Number of people per- km^2	Demand	TURKSTAT
	Inverse Land Supply (Land Availability)	Area of conservation areas in the region (km^2)/total area of the region (km^2) (This is a time invariant variable.)	Supply	Ministry of Culture and Tourism, Republic of Turkey
	Road Ratio	Length of roads in the region/total area of the region	Demand	TURKSTAT
	Vehicle Ratio	Number of vehicle/population	Demand	TURKSTAT
	Health Services Quality	Number of doctors/population	Demand	TURKSTAT
	Crime Rate	Number of convicted people/population	Demand	TURKSTAT

(Cont. on next page)

Table 5.5. (Cont.)

Groups	Variable Name	Definition	Side	Source
CL (Climatic and geographic variables)	Seaside Ratio	Length of sea shores in region/total area of the region (This is a time invariant variable.)	Demand	TURKSTAT and own calculations (for shore length)
	Temperature	Average temperature of the cities in the region (Average of the period between 1950-2015 used) (This is a time invariant variable.)	Demand	Turkish Ministry of Forestry and Water Affairs, General Directorate of Meteorology, Republic of Turkey
	Earthquake Risk	Average of the degree of earthquake of cities in the region (Ranging from 1 to 4) (This is a time invariant variable.)	Demand	Prime Ministry Disaster and Emergency Management Presidency, Republic of Turkey
	Sunshine Duration	Average duration of sun (Hours) per day	Demand	Meteorological Service, Republic of Turkey
CU (Cultural variables)	Cultural Activity Ratio	Number of people participated in cinema, theater and libraries/population	Demand	TURKSTAT

Table 5.6. Regression Results, Fixed Effect LSDV Method[4]

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
HPI (t-1)	0,292**	0,292**	0,383***	0,316***	0,269**	0,277**	0,264**	0,313***	0,387***	0,309***
Population (t-1)	0,000001**	0,000001**		0,000001**		0,000001***				0,000001**
Employment (t-1)	0,181	0,171	0,085		0,165		0,177	0,125	0,094	
Inverse Land Supply (t-1)	-1,713	19,051	-1,392	-1,560	-3,666					
Inflation (t-1)	-0,125	-0,234	-0,130	-0,057	-0,118	-0,076	-0,142	-0,108	-0,147	-0,099
c	-1,045	0,742	2,738	8,069	0,484	4,748	0,346	1,866	3,875	10,589
Student Ratio (t-1)		-4,305								
Earthquake Risk (t-1)			0,507							
Student-Teacher Ratio (t-1)				-0,071						
Population Density (t-1)					0,003***					
Vehicle Ratio (t-1)						2,242**				
Seaside Ratio (t-1)							6,84***			
Trade Openness (t-1)								0,00035*		
Net Migration Rate (t-1)									0,045	
Household Size (t-1)										-0,735
Adjusted R-Squared	0,36	0,36	0,31	0,34	0,36	0,38	0,38	0,33	0,31	0,35
Jarque-Bera Normality Test	3,44	2,97	1,7	3,61	2,95	3,94	2,87	1,45	1,57	3,86

(Cont. on next page)

[4] Note: *** donates the value is significant at 1%; ** donates it is significant at 5% and * donates it is significant at 10% level.

Table 5.6. (Cont.) [5]

Variables	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20
HPI (t-1)	0,360***	0,329***	0,396***	0,267**	0,403***	0,286***	0,388	0,395***	0,387***	0,400***
Population (t-1)						0,000001***				
Employment (t-1)	0,148									
Inverse Land Supply (t-1)		-47,190								
Inflation (t-1)	-0,154	0,023	-0,152	-0,107	-0,113		-0,144	-0,155	-0,088	
c	-3,520	3,397	-2,636	7,763	6,877	4,155**	5,969	11,703	8,119	6,504***
Urbanization Rate (t-1)	0,08**									
Cultural Activity Ratio (t-1)		5,2**								
Labor Participation Rate (t-1)			16,396							
Sunshine Durability (t-1)				0,086						
Temperature (t-1)					0,023					
Crime Rate (t-1)						1,4**				
Bachelor Rate (t-1)							30,825			
Age Dependency (t-1)								-0,067		
Road Ratio (t-1)									-2,651	
Health Services Quality (t-1)										-85511,5
Adjusted R-Squared	0,34	0,34	0,31	0,24	0,3	0,37	0,32	0,31	0,31	0,3
Jarque-Bera Normality Test	2,18	2,81	1,7	4,07	1,43	6,37**	1,99	1,69	1,57	1,59

[5] Note: *** donates the value is significant at 1%; ** donates it is significant at 5% and * donates it is significant at 10% level.

To start with economic variables, only trade openness variable has a significant coefficient (with positive sign). In other words, economically more open regions are likely to have faster appreciation in housing prices. This result is plausible as open regions attract people more as they are likely to have a better quality of life and high diversity in consumption goods. In terms of demographic variables, only population, which is also our control variable, has a significant and positive impact on housing prices.

In contrast to the first two groups, urbanization group of variables contain more promising effects. Population density, urbanization rate, vehicle ratio and crime rate have positive and significant impacts. These results actually mean that urbanization brings faster valuation in real estate products.

Moreover, two valuable variables which are not yet adequately mentioned in the literature are found significant. The first one is the seaside ratio variable which is included in climatic and geographic variables group. It has a positive and significant coefficient. So, within the regions that there is sea, lighter climatic conditions are present that attract people to live there. Hence, housing prices tend to increase faster in these regions. Second important variable is the cultural activity ratio. The intensity of participation in cultural activities such as cinema, theatre and utilization of libraries have a positive impact on housing prices as these regions become increasingly attractive residential places for people.

Finally, lagged value of Δhpi has also been found positive and significant in all models. It, thus, confirms once more the importance of speculative behavior in housing markets.

In almost all regression models, normality of errors are confirmed by a Jarque-Bera Test statistics (presented in the last raw of Table 5.6).

Overall, one may argue that urbanization, climate and cultural characteristics matter for real estate markets in Turkey. A typical region that experience fast housing appreciation can be defined in a following way: Metropolitan regions that include high population, density, seaside, economic openness and dense cultural activities are likely to experience faster increase in housing prices.

5.4. Robustness of Results

A final step in our empirical investigation is to check the robustness of our results. We perform two types of controls.

The first one is related to reverse causality. If present, reverse causality indicates misleading results in case the dependent variable causes the independent variable; but, not the other way around.

To understand this, we apply a Bi-Variate Panel Granger Causality Tests (Granger, 1969). We concentrate only on the variables that are found significant in the regression analysis. The results are presented below in Table 5.7.

Table 5.7. Granger Causality Test Results

Number	Null Hypothesis	F-Stat	P-Value	Decision
1	POPULATION does not Granger Cause HPI	14,67***	0,00	Reject
	HPI does not Granger Cause POPULATION	0,08	0,78	Accept
2	POPULATIONDENSITY does not Granger Cause HPI	12,35***	0,00	Reject
	HPI does not Granger Cause POPULATIONDENSITY	0,13	0,72	Accept
3	VEHICLERATIO does not Granger Cause HPI	15,66***	0,00	Reject
	HPI does not Granger Cause VEHICLERATIO	0,21	0,64	Accept
4	URBANIZATIONRATE does not Granger Cause HPI	13,08***	0,00	Reject
	HPI does not Granger Cause URBANIZATIONRATE	3,39*	0,07	Reject
5	CRIMERATE does not Granger Cause HPI	5,58**	0,02	Reject
	HPI does not Granger Cause CRIMERATE	0,49	0,49	Accept

(Cont. on next page)

Table 5.7. (Cont.)

Number	Null Hypothesis	F-Stat	P-Value	Decision
6	SEASIDERATIO does not Granger Cause HPI	21,47***	0,00	Reject
	HPI does not Granger Cause SEASIDERATIO	-101,00	1,00	Accept
7	CULTURALACTITIVY does not Granger Cause HPI	7,72***	0,01	Reject
	HPI does not Granger Cause CULTURALACTIVITY	0,65	0,42	Accept
8	TRADE does not Granger Cause HPI	13,09***	0,00	Reject
	HPI does not Granger Cause TRADE	1,62	0,21	Accept

Hence, 7 tests are performed. In all of them, the independent variables cause the dependent variable significantly; but, not vice versa. Therefore, we can safely argue that the relationships are uni-directional (from independent ones to the dependent variable) and there exists no reverse causality.

Second type of robustness check is related to possibility of spatial dependence in panel regression (equation (5.2)). If spatial dependence is present; but, not incorporated in the regression, the estimations will be misleading and coefficients will be biased (Anselin, 1988).

So, we apply 5 different types of spatial autocorrelation tests to our base model (Model 1 in Table 5.7). These tests are respectively Lagrange Multiplier Error (LMerr), Lagrange Multiplier Lag (LMlag), Robust Lagrange Multiplier Error (RLMerr), Robust Lagrange Multiplier Lag (RLMlag) and Spatial Autoregressive Moving Average (Sarma) tests.

Their test statistics are presented in Table 5.8 below. As seen, none of the test statistics are significant. Hence, it appears no spatial dependence in the estimation of our regression model. Thus, our results seem robust against spatial autocorrelation.

Table 5.8. Spatial Dependence Tests

Test	**2012**	**2013**	**2014**	**2015**
Lmerr	2,23	1,17	1,02	1,06
Lmlag	2,18	0,79	0,13	0,07
Rlmerr	0,08	0,49	2,14	1,41
Rlmlag	0,02	0,12	1,25	0,43
Sarma	2,26	1,29	2,27	1,48

CHAPTER 6

CONCLUSION

In recent years, Turkey is faced with excessive increases in housing prices. In the 2010-2016 periods the average increase in the price of housing is up to almost 96.5% (CBRT, 2016). Herein, the lowest appreciation is about 56.8%; the highest rate reaches to 177.4% which is almost doubled. Thus, housing price dynamics are necessarily needs to more attention.

Correspondingly, this paper is based on 2 major aspects as (1) to investigate the relative (%) impacts of fundamental and speculative determinants on housing price appreciation and (2) to determine the dynamics behind the regional disparities on housing price movements.

For the time series analysis, Housing Price Index (HPI) and Consumer Price Index (CPI) are used to determine for the impact of speculation. Besides, Consumer Confidence Index (CCI), Building Construction Cost Index, Employment Rates, Housing Interest Rates, Money Supply (M2), Building Permissions (M2) represents fundamental variables.

On the other hand, economic variables, demographic variables, urbanization, climatic and geographic variables, cultural variables are constructed for the cross-sectional analysis.

To cope with all of these, we constitute a wide range of time series and panel data methodologies such as VAR, Unit Root Analysis, Cholesky Forecast Error Variance Decompositions, Impulse-Response Functions, Fixed Effect Panel Regressions, Kernel Distributions, Lagrange Multiplier Spatial Dependence Tests and Granger Causality Tests.

Our results can be summarized in three groups. First, housing price appreciations are so heterogeneous across regions. Moreover, the dispersion is getting even more pronounced over time.

Second, we found that speculative increase in housing prices is quite important. Such as about 38-40% of the housing appreciation is attributed to this factor whereas fundamental determinants account for about 60-62% of the price changes. Among the fundamental variables, construction permissions, long-run interest rate and

regional inflation rates are among the most important ones that are found the decline the property appreciation.

Third, in terms of cross-sectional determinants, urbanization rate, population, crime rate, trade openness, seaside ratio and cultural activity ratio of the regions are found to increase significantly the housing prices. Seaside ratio and cultural activity ratio are the significant climate and cultural variables. In terms of urbanization variables, crime rates and vehicle ratio are found significant. These variables are not yet well discovered in the literature.

Overall, our results indicate an important policy suggestion. A very special attention needs to be paid on the significance of the speculation factor. In order to avoid the credit bubbles driven by speculative herding behavior of investors, new regulations on housing and credit market should be introduced. The unsafe and inefficient credits should be hampered so to overcome the possibility of an artificial housing price bubble and its destructive impact on macro-economy.

Besides, speculative behavior should be distributed to get more equality between regions with planning decisions. Also, this factor should be controlled and directed by local institutions, for example municipalities.

Moreover, our regional determinants such urbanization rate, population, population density, crime rate, vehicle ratio, which are mainly related to urbanization and demography, sign that housing price increases in more crowded regions are accelerated due to the demand. It seems that these accelerations can be controlled by more supplied units theoretically; but, new development areas, large urban development projects, urban renewal projects, flagship projects, skyscrapers and especially gated communities can trigger to the housing prices, especially, when these investments dense in particular regions. Herein, the role of planning come to fore. Regional housing price differentiations can be under the control by leading to distribute all the urbanization factors between regions with the help of new investments.

Also, the impacts of cultural activity can be expanded through regions by new decisions. The creation of more equal opportunities to participate in social facilities as cinema, theatre and libraries etc., can reduce to diverge between regions.

Some regional climatic and geographical factors as seaside ratio and temperature which are place specific are constant for some regions and cannot be changed. However; it can be balanced by discovering other regions own unique characteristics, improving their existing living standards and public facilities.

All these regional findings should be taken into consideration in planning decisions to avoid regional inequalities and to increase housing affordability.

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APPENDIX A

NUTS 2 DIVISIONS OF REGIONS

Table A.1. NUTS 2 Divisions of Regions
(Source: TURKSTAT, 2016)

Region	Provinces
TR10	İstanbul
TR21	Tekirdağ, Edirne, Kırklareli
TR22	Balıkesir, Çanakkale
TR31	İzmir
TR32	Aydın, Denizli, Muğla
TR33	Manisa, Afyon, Kütahya, Uşak
TR41	Bursa, Eskişehir, Bilecik
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR51	Ankara
TR52	Konya, Karaman
TR61	Antalya, Isparta, Burdur
TR62	Adana, Mersin
TR63	Hatay, Kahramanmaraş, Osmaniye
TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
TR72	Kayseri, Sivas, Yozgat
TR81	Zonguldak, Karabük, Bartın
TR82	Kastamonu, Çankırı, Sinop
TR83	Samsun, Tokat, Çorum, Amasya
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane
TRA1	Erzurum, Erzincan, Bayburt
TRA2	Ağrı, Kars, Iğdır, Ardahan
TRB1	Malatya, Elazığ, Bingöl, Tunceli
TRB2	Van, Muş, Bitlis, Hakkari
TRC1	Gaziantep, Adıyaman, Kilis
TRC2	Şanlıurfa, Diyarbakır
TRC3	Mardin, Batman, Şırnak, Siirt

APPENDIX B

HOUSING PRICE APPRECIATIONS FOR THE PERIOD BETWEEN 2010-2016

This part includes the maps of regional housing price increase rates of Turkey for the period 2011-2016 separately. These maps provide us to follow the shifts of increase rates in years.

Additionally, they include the average of housing price increases for the same period.

At last, there is a map which also shows housing price increases for the period 2011-2016, which is measured by hedonic house price index.

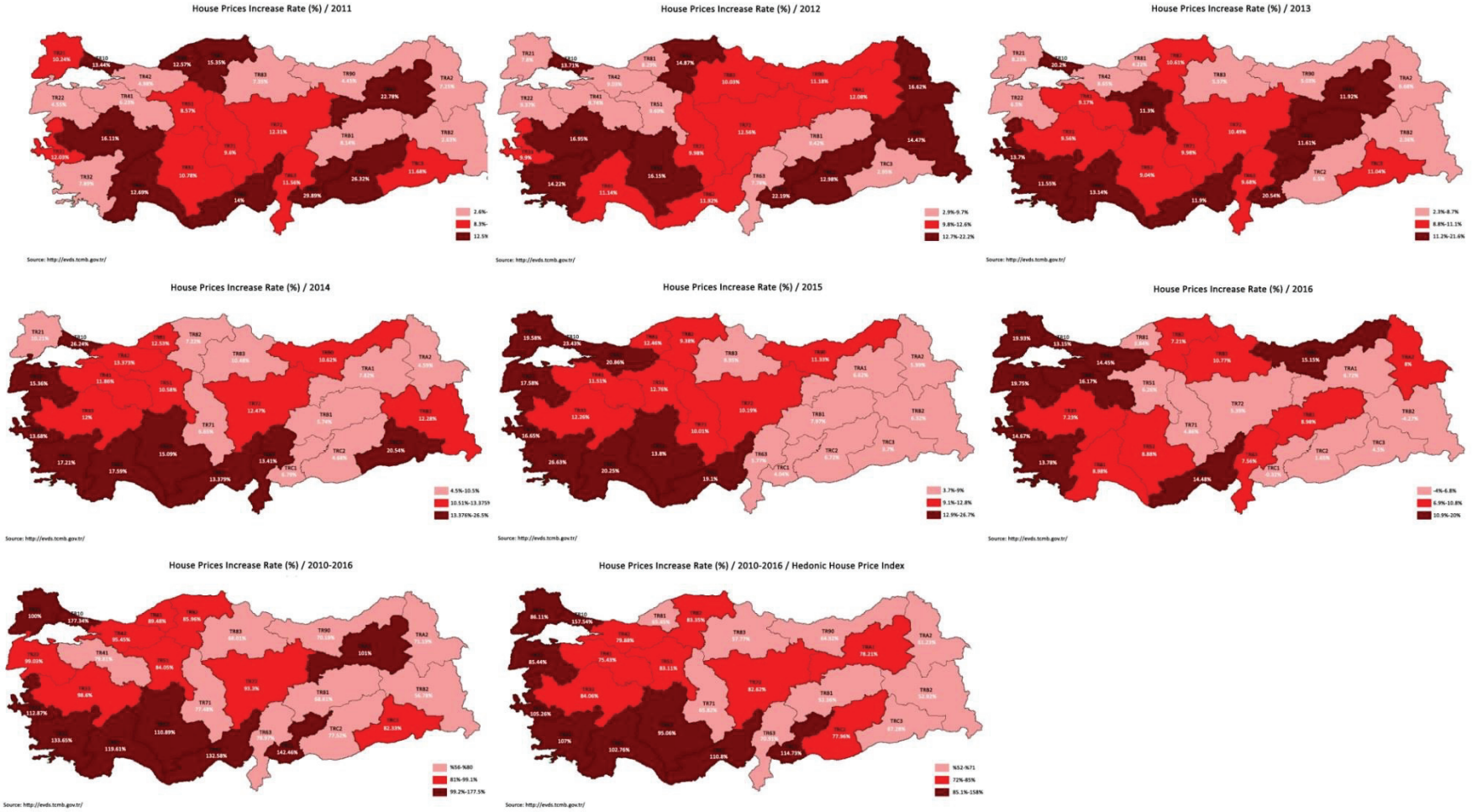

Figure B.1. Geographical Distribution of Housing Price Appreciation, 2011-2016
(Source: CBRT, 2016)