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Convergence in House Prices: Cross-Regional Evidence for Turkey

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Convergence in House Prices: Cross-Regional Evidence for Turkey*

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Abstract

This paper analyzes the long-run convergence of regional house prices in Turkey. Using a non-linear time-varying factor model and quarterly house price data for the period between 2010 and 2018, we find that house prices do not converge across the 26 regions. The results reveal that the regions can be grouped into seven convergence clubs and one divergent club, confirming the heterogeneity and complexity of the Turkish housing market. These results also imply the existence of multiple steady states in the housing market. These outcomes will be beneficial to home buyers/sellers, investors, regulators and policymakers, who are interested in analyzing the dynamic interlinkages among house prices and the effects of shocks originating from the regional housing markets.

Keywords: housing market, house prices, log-t test, regional convergence

JEL Classification: R31, O18, C33

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Non-Technical Summary

Housing is a type of asset that plays a dual role as a consumption and investment good. As housing generally constitutes the largest component of the financial assets held by households, housing loan debts also create one of the main obligations of households. Furthermore, housing sector contribute to a considerable portion of GDP in many countries. Hence, large corrections in house prices in the aftermath of Global Financial Crisis of 2007-2008 (GFC) had serious impacts on households' wealth and consumption in many countries, as well as residential investment. Accordingly, the dynamics of house prices are important in terms of both household wealth and business cycles.

Following GFC, a growing literature has been devoted to studies that investigated the dynamics of house prices in developed and developing countries at both regional and national level. In recent years, the focus is more directed to the interrelationship between regional house prices since the co-movement and the dynamic interactions of house prices across regions can have implications for home buyers/sellers, investors, regulators and policymakers.

Inspiring by these developments, our study aims to examine the long-run dynamics and the interlinkages of house prices for a developing country such as Turkey. Since the housing sector in Turkey provides an important contribution to economic growth, house prices have been surging persistently since 2010 on the basis of increasing demand, prosperous growth of the housing sector has been parallel to young and growing population and migration from rural areas to urban cities increases the demand for the construction of new buildings in urban areas, Turkey represents a good case study for studying the convergence behavior of house prices. Henceforth, these dynamics of the housing sector in Turkey has motivated us to explore long-run dynamics and interactions of house prices across the 26 regions of Turkey over the period 2010-2018.

The results of this study provide no evidence of house price convergence across the 26 regions of Turkey. On the other hand, findings suggest that regional housing market can be characterized by the presence of multiple steady states in the Turkish housing market instead of a single steady state. We observe seven convergence clubs and one divergent club. In a nutshell, except the four regions within the divergent club, most of which are economically less developed regions of Turkey, all other regions show a pattern of converging to a common house price. These results suggest evidence for the heterogeneity in regional housing markets of Turkey, which may arise from economic, social and spatial factors.

1. Introduction

Housing is a type of asset that plays a dual role as a consumption and investment good. As housing generally constitutes the largest component of the financial assets held by households, housing loan debts also create one of the main obligations of households. Furthermore, housing sector contribute to a considerable portion of GDP in many countries. Hence, large corrections in house prices in the aftermath of Global Financial Crisis of 2007-2008 (GFC) had serious impacts on households' wealth and consumption in many countries, as well as residential investment (OECD, 2011). Accordingly, the dynamics of house prices are important in terms of both household wealth[1] and business cycles[2].

Following GFC, a growing literature has been devoted to studies that investigated the dynamics of house prices in developed and developing countries at both regional and national level. In recent years, the focus is more directed to the interrelationship between regional house prices since the co-movement and the dynamic interactions of house prices across regions can have implications for home buyers/sellers, investors, regulators and policymakers. In pursuit, the issue of whether there is a reduction in the cross-sectional dispersion of house prices over time is questioned along with the issue of convergence. Several arguments have been raised so as to explain why house prices may converge across regions.[3] One of them is the assumption that fundamentals affecting house prices such as income or interest rate may converge across regions. Considering the fact that housing can be evaluated as an asset class, housing risk premia may converge across regions even when these fundamentals do not converge.

Conceptually, convergence refers to a decline in the dispersion among regions. Although convergence is more of an issue of achieving economic cohesion among countries in income growth rates and reducing income inequality[4], it has also been applied to a wide range of areas such as macroeconomic convergence, labor income evolution, stock and bond markets, commodity

[1] See Catte et al. (2004) and Fry et al. (2010).
[2] See Quigley (1999) and Ghent and Owyang (2009).
[3] See, for example, Abbott and De Vita (2013), Hiebert and Moreno (2010) and Churchill et al. (2018), among others.
[4] See Azomahou et al. (2011).

markets, house prices and so forth.[5] Among them, an extensive research has been devoted to examine convergence of house prices across regions and nations.[6]

Along with this line of research, co-movement of house prices in developed countries has been studied, but rather less interest has been dedicated to these dynamics in developing countries. Thus, the core objective of this study is to examine the long-run dynamics and the interlinkages of house prices for a developing country. We decided to examine house prices of Turkey, since the housing sector in Turkey is quite dynamic and represents a good case study in several ways. Firstly, it provides an important contribution to economic growth as the growth rate of the construction sector has been very well above that of GDP on the occasion of positive growth rates since almost two decades. Share of the construction sector within overall GDP has been on a rising trend since 1998, reaching the highest share with 9 percent in 2016 and 2017. On the other side, house prices have been surging persistently since 2010 on the basis of increasing demand, leading to worries about bubble-like behavior.[7] Prosperous growth of the housing sector in Turkey has been parallel to young and growing population of Turkey. Turkey's population migrates from rural areas to urban cities increasing the demand for the construction of new buildings in urban areas. Furthermore, arrival of Syrian refugees after civil war in Syria since 2011 has created a demand for the housing sector. Considering Turkey has hosted approximately 3.6 million refugees as of 2019[8], local dynamics have changed a lot in some cities like İstanbul, Bursa, İzmir, Gaziantep, Konya, Hatay, Adana, Mersin, Kilis and Şanlıurfa leading to regional differences.[9] Henceforth, these dynamics of the housing sector in Turkey has motivated us to explore long-run dynamics and interactions of house prices across the 26 regions of Turkey over the period 2010-2018. The novelty of this paper is to comprise *regional* housing price data of Turkey to question whether a unique long-run equilibrium exists for the Turkish housing market where all regions converge to, through employing a recent econometric methodology. In other words, this methodology enables us to test whether regional house prices convergence over time.

[5] See Herrerias et al. (2017) and Kim et al. (2006) for a detailed review of the related studies.
[6] See, for example, Abbott and De Vita (2013), Montanes and Olmos (2013), Yunus and Swanson (2013) and Yunus (2015), among others.
[7] The rate of increase in nominal hedonic house prices between January 2010 and December 2018 has been 133 percent. The rate of increase has begun to decline since 2015.
[8] http://www.goc.gov.tr/icerik3/gecici-koruma_363_378_4713.
[9] See the map on the above link and also Akgunduz et al. (2015).

Empirical methodology employed to tackle with the convergence issue has been through the traditional time series approach introduced by the seminal papers of Carlino and Mills (1993) and Bernard and Durlauf (1995, 1996). This approach is based upon the existence of a cointegrating relationship between non-stationary variables. However, as later criticized by Phillips and Sul (2007, 2009), these standard unit root tests may suffer from over-rejections of the unit-root hypothesis (Ng and Perron, 2001). In addition, time series approach can be inadequate when there is heterogeneity across regions or countries. Henceforth, the technique suggested by Phillips and Sul (2007, 2009) accounts for individual heterogeneity and the need of capturing this behavior in empirical modeling. It develops an econometric test of convergence for the time varying idiosyncratic components. This new regression test (*log-t* test) explores whether there exists a convergence towards a single common component in the long-run. If not, it also questions the possible segmentation of the market in the form of a convergence club where they converge to their own steady state. To that aim, a club convergence clustering algorithm is employed, i.e., panel data is clustered into clubs with similar convergence characteristics.

In the literature, the questions of whether house prices converge across regions in Turkey and do have a long-run relationship have not taken adequate consideration. There is only one study by Çatık et al. (2017) that addresses the issue of house price convergence through employing cointegration analysis to explore the long-run relationship among the house prices in 18 cities. Since heterogeneous dynamics present in the regional house prices of Turkey requires more than the conventional convergence tests can provide, we contribute to the literature through adopting the methodology (*log-t* test) introduced by Phillips and Sul (2007, 2009). In other words, transitional dynamics in the presence of individual heterogeneity has been taken into account and the number of steady states among regions as well as the compositions of multiple equilibria is analyzed in this study.

In essence, our results propose the existence of multiple steady states in the Turkish housing market. In other words, there are seven convergence clubs and one divergent club. All regions in each convergence club, except the four regions within the divergent club, converge to a common house price. On the other hand, none of the four regions in the divergent club shows a convergence pattern with any of the other 22 regions. These results suggest evidence for the heterogeneity in regional housing markets of Turkey, which may arise from economic, social and spatial factors.

The article is organized as follows: Section 2 outlines the methodology and the rationale behind the convergence test. Section 3 involves a brief description of data and empirical application of *log-t* test to find out convergence in the house prices across 26 regions of Turkey using hedonic house price indices. Section 4 discusses the concluding remarks.

2. Testing House Price Convergence

The methodologies employed in the convergence analysis have been several so far such as the principle components approach (e.g., Holmes and Grimes, 2008), the panel unit root tests (e.g., Levin et al., 2002), cointegration tests (e.g., Yunus, 2015) and dynamic panel data methodologies (e.g., Caselli et al., 1996; Kılınç et al., 2017). Shortcomings of these methods emerge in the presence of individual heterogeneity. Although factor models have been widely used to integrate heterogeneous agent behavior into econometric modelling[10], again these models do not provide any advantages over standard unit root tests (Kim and Rous, 2012). Instead, the relative convergence concept used by Phillips and Sul (2007) accommodate for evolution in heterogeneous behavior. In that respect, we apply the methodology of Phillips and Sul (2007) to test whether cross-sectional dispersion of regional house prices shows a tendency to decrease over time, i.e., converge. This methodology allows us to analyze heterogeneous transitional dynamics in house prices across regions. Furthermore, the methodology is able to identify possible segmentation of the market in the form of a convergence club.

Phillips and Sul (2007) developed the *log(t)* regression test for convergence hypothesis based on a non-linear time-varying factor model. The starting point of the model is to decompose the panel data X_{it} with time (*t=1, …, T*) and region (*i=1, …, N*) as:

$$X_{it} = g_{it} + a_{it} \tag{1}$$

where g_{it} represents the permanent component and a_{it} is the transitory component.

Since both components may contain a common factor across regions, Eq. (1) can be transformed as:

[10] Among others, see Stock and Watson (2002) and Bai (2003).

$$X_{it} = \left[\frac{g_{it}+a_{it}}{\mu_t}\right]\mu_t = \delta_{it}\mu_t \tag{2}$$

where μ_t is the single common component across regions and δ_{it} is the time varying idiosyncratic factor which captures the deviation of region i from the common growth path defined by μ_t. To estimate δ_{it}, we need to eliminate μ_t through rescaling the panel average as

$$h_{it} = \frac{X_{it}}{(\frac{1}{N})\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{(\frac{1}{N})\sum_{i=1}^{N} \delta_{it}} \tag{3}$$

where h_{it} captures the transition path with respect to the panel average at time *t*.

In order to test the convergence and define club convergence, a semi-parametric form for the time-varying coefficients such that $\delta_{it} = \delta_i + \sigma_{it}\omega_{it}$, where $\sigma_{it} = \frac{\sigma_i}{L(t)t^{\alpha}}$, $\sigma_i > 0$, $t \geq 1$, and ω_{it} is weakly dependent over *t*, but $iid(0,1)$ across i, is required. The function $L(t)$ equals to *log(t)*, is increasing in *t* and divergent, as *t* tends to infinity. In other words, whether or not X_{it} converges[11] toward δ_i will be determined by the size of α. Phillips and Sul (2007) shows that the convergence is ensured if $\alpha \geq 0$, and this null hypothesis of convergence is:

$$\mathcal{H}_0: \delta_i = \delta \text{ and } \alpha \geq 0$$

against the alternative hypothesis for non-convergence for some i: $\mathcal{H}_A: \delta_i \neq \delta$ or $\alpha < 0$.

Phillips and Sul (2007) developed a *t* test for the null hypothesis of convergence which can be tested using the following equation:

$$\log\left(\frac{H_1}{H_t}\right) - 2\log(\log(t)) = c + blog(t) + \varepsilon_t \quad \text{for } t = [rT], [rT+1], \dots, T \text{ with } r > 0 \tag{4}$$

[11] The convergence of X_{it} requires the following condition: $\lim_{t\to\infty} \frac{X_{it}}{X_{jt}} = 1$, for all i and j.

where $H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2$ and $b = 2\alpha$ and the null hypothesis is constructed as one-sided test of $b \geq 0$.[12] A rejection of the null hypothesis at the 5% level of significance occurs when $t_b < -1.65$.

Rejection of the null hypothesis of convergence in the panel does not exclude the potential that convergence may occur in subgroups of panel, because multiple equilibria can be present (Churchill et al., 2018). Henceforth, club merging tests are performed, in which the strategy is to search for convergence across all combinations of regions until $N - k = 1$, where k is the number of regions in the convergence clubs.

In short, Phillips and Sul (2007) developed a data driven algorithm to investigate the possibility of convergence clubs. The sequence of steps involved in the clustering algorithm can simply be explained as follows: (i) sorting individuals (regions in our case) according to the last time series observation in the panel; (ii) finding a core convergence group that yields the highest value of the *log-t* test statistic to evaluate additional individuals for membership of this group; (iii) sieving individuals for club membership; (iv) performing the *log-t* test for the subgroup of remaining individuals which are not sieved in the previous step and checking the test statistic for the evidence of convergence; and (v) performing the *log-t* test for all pairs of the subsequent initial clubs to merge those clubs fulfilling the convergence hypothesis jointly.

3. Data and Empirical Results

3.1. Data

Our main data is the Hedonic House Price Index (HHPI), which measures quality-adjusted price changes related to housing characteristics. The HHPI database is produced by the Central Bank of the Republic of Turkey (CBRT) and announced monthly starting from January 2010 for whole country and 26 geographical regions at NUTS2 level. We utilize the HHPI in nominal values and on quarterly basis over the period 2010Q1-2018Q4. Table 1 presents the summary statistics for the regional house prices of Turkey. Over the examined period, it is observed that TR10 (Istanbul) has the highest mean house price. The second region in that terms is TRC1 (Kilis, Adıyaman,

[12] The selection of the initiating sample fraction r might influence the results of the regression represented by Eq. (4). The Monte Carlo experiments indicate that $r \in [0.2,\ 0.3]$ achieves a satisfactory performance. Specifically, it is suggested to set $r = 0.3$ for the small or moderate T (≤ 50) sample and set $r = 0.3$ for the large T (≥ 100) sample (Phillips and Sul, 2007).

Gaziantep), which has hosted Syrian refugees since 2011. On the other hand, the region of TRB2 (Van, Bitlis, Hakkari) has the lowest mean house price.

We choose to eliminate cyclical components of the data to improve the finite sample power and size of the test, as suggested by Phillips and Sul (2007). Hence, we use the Hodrick and Prescott (1997) filter to remove the cyclical components in the data.

Table 1. Summary Statistics

Regions	*Mean*	*Median*	*Maximum*	*Minimum*	*Std. Dev.*
TR10	181.48	169.34	273.11	98.45	64.79
TR21	146.39	127.99	232.34	99.17	44.70
TR22	146.31	129.02	236.98	99.08	44.96
TR31	163.77	149.38	266.80	98.58	54.28
TR32	158.11	140.79	261.89	97.04	53.89
TR33	154.52	149.84	221.48	98.61	39.28
TR41	144.90	133.37	219.68	99.15	39.84
TR42	141.96	127.50	210.94	98.40	38.83
TR51	146.37	143.28	201.90	98.41	33.80
TR52	154.15	150.55	226.78	97.11	42.05
TR61	160.13	151.79	243.35	99.30	47.27
TR62	158.20	146.11	237.20	98.34	47.09
TR63	141.68	141.61	192.57	98.96	30.67
TR71	140.86	142.06	191.20	97.29	29.08
TR72	151.97	147.43	229.25	99.49	38.22
TR81	136.28	132.17	189.03	94.55	26.17
TR82	154.80	148.25	233.44	99.65	39.10
TR83	135.73	128.78	194.64	98.95	30.97
TR90	135.73	126.93	197.55	98.69	32.12
TRA1	152.94	152.37	211.98	97.78	33.43
TRA2	132.99	137.32	163.60	93.22	19.75
TRB1	133.82	130.94	192.82	98.65	28.08
TRB2	130.44	129.30	184.71	97.45	22.52
TRC1	178.03	196.95	242.81	99.06	46.28
TRC2	152.66	158.97	196.90	96.92	27.91
TRC3	141.78	150.15	168.06	97.64	24.16

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

3.2. Empirical Results

Table 2 presents the results of the *log(t)* convergence tests across the 26 regions of Turkey.[13] The findings indicate a rejection of the full panel convergence at 5 percent level of significance (or even at 1 percent) (*t-stat* = -14.79 < -1.65). Hence, the result of the *log(t)* regression test suggests no evidence of house price convergence for the total sample of 26 regions of Turkey over the period 2010Q1-2018Q4.[14]

Table 2. *Log(t)* test results (26 regions)

Variable	Coefficient	Standard Error	T-Statistic
House price	-1.22	0.08	-14.79*

Notes: * denotes the rejection of the null hypothesis of convergence at 5% significance level. The number of regions is 26. The number of time period is 36. The first 12 periods are discarded before regression.

Since the null hypothesis of overall house price convergence is firmly rejected, we may now investigate whether house prices converge to their own steady states within subgroups. In other words, at this stage, it becomes necessary to examine the potential club convergence pattern among the 26 regions of Turkey. To that purpose, we apply the clustering procedure proposed by Phillips and Sul (2007) to 26 regions.

Table 3 shows the results of implementing these clustering procedures to the data of 26 regions. Direct application of the clustering algorithm classifies the regional data into eight subgroups. We observe that seven of these subgroups form convergence clubs. The last subgroup, i.e., Group 8, significantly rejects convergence, providing evidence for the divergence of four regions: TR90 (Artvin, Giresun, Gümüşhane, Ordu, Rize, Trabzon), TRA2 (Ağrı, Ardahan, Kars, Iğdır), TRB1 (Bingöl, Elazığ, Malatya, Tunceli) and TRB2 (Van, Bitlis, Hakkari, Muş). In other words, none of

[13] We use a Stata module developed by Du (2017) to perform econometric convergence analysis and club clustering proposed by Phillips and Sul (2007).

[14] We also carry the *log(t)* regression tests using the real hedonic house prices data, which are obtained through deflating nominal hedonic house price of each region by regional consumer price index. We did not observe any significant change in the convergence tests with real house price data, whilst the number of convergence clubs is reduced to four. As the related literature did not make any emphasis on the difference between using the real versus nominal prices, we prefer to use nominal house prices. The main motivation behind choosing nominal house prices is that they show higher variations across time and regions, while the real house prices did not increase dramatically during the period of analysis in Turkey. The results with the real house prices are available upon request.

these regions shows a pattern of converging to a common house price. Henceforth, the initial clustering suggests seven sub-convergence clubs and one divergent club.

Convergence clubs can be summarized as follows: The first convergence club includes two regions, which are TR10 and TRC1. The second club again involves two regions, i.e., TR31 and TR32. The third club includes TR61 and TR62. The fourth club is composed of seven regions, which are TR21, TR22, TR33, TR52, TR72, TR82 and TRA1. The fifth club includes four regions such as TR41, TR42, TR51 and TRC2. The sixth club includes TR63, TR71 and TRC3. The last convergence club includes two regions like TR81 and TR83.

Table 3. Initial convergence club classification: 26 Regions from 2010Q1 to 2018Q4

Clusters	Regions	Coefficient	T-Statistic
Club 1	TR10, TRC1	-2.72	-1.63
Club 2	TR31, TR32	0.11	0.38
Club 3	TR61, TR62	0.43	15.63
Club 4	TR21, TR22, TR33, TR52, TR72, TR82, TRA1	0.31	2.14
Club 5	TR41, TR42, TR51, TRC2	1.11	1.97
Club 6	TR63, TR71, TRC3	0.02	0.04
Club 7	TR81, TR83	-0.28	-0.22
Group 8 (Divergent)	TR90, TRA2, TRB1, TRB2	-2.45	-9.95*

Notes: * denotes the rejection of the null hypothesis of convergence at 5% significance level. The t-statistic is the convergence test statistic, which is distributed as a simple one-sided *t*-test with a critical value of -1.65 (see Phillips and Sul (2007) for further details).
Regions: TR10 = İstanbul; TR21 = Edirne, Kırklareli, Tekirdağ; TR22 = Balıkesir, Çanakkale; TR31 = İzmir; TR32 = Aydın, Denizli, Muğla; TR33 = Afyonkarahisar, Kütahya, Manisa, Uşak; TR41 = Bursa, Eskişehir, Bilecik; TR42 = Bolu, Kocaeli, Sakarya, Yalova, Düzce; TR51 = Ankara; TR52 = Konya, Karaman; TR61 = Antalya, Burdur, Isparta; TR62 = Adana, Mersin; TR63= Hatay, Kahramanmaraş, Osmaniye; TR71 = Nevşehir, Niğde, Aksaray, Kırıkkale, Kırşehir; TR72 = Kayseri, Sivas, Yozgat; TR81 = Zonguldak, Bartın, Karabük; TR82 = Çankırı, Kastamonu, Sinop; TR83 = Samsun, Çorum, Amasya, Tokat; TR90 = Artvin, Giresun, Gümüşhane, Ordu, Rize, Trabzon; TRA1 = Erzurum, Erzincan, Bayburt; TRA2 = Ağrı, Ardahan, Kars, Iğdır; TRB1 = Bingöl, Elazığ, Malatya, Tunceli; TRB2 = Van, Bitlis, Hakkari, Muş; TRC1 = Kilis, Adıyaman, Gaziantep; TRC2 = Diyarbakır, Şanlıurfa; TRC3 = Batman, Mardin, Siirt, Şırnak.

It is probable that the number of convergent clubs that we obtained can be more than the one actually exists due to excessively conservative nature of the clustering algorithm proposed by Phillips and Sul (2007). Hence, given that these seven clusters seem too many, we can investigate

whether any of the adjacently numbered clubs can be merged to form larger convergence clubs by following Phillips and Sul (2009).

The results of club merging analysis are presented in Table 4. Since the results indicate no evidence to maintain mergers of the original groupings, the initially formed clubs are maintained. Hence, each club forms a separate convergence club.

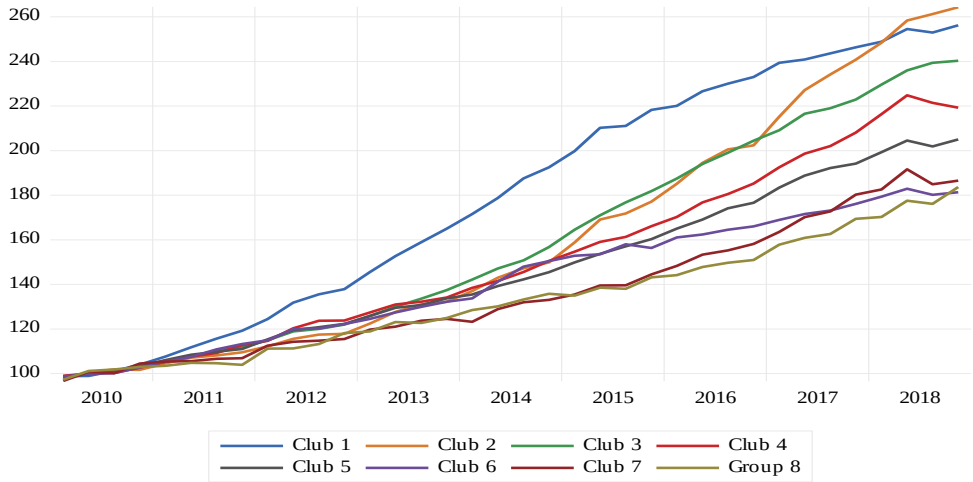
Table 4. Club merging classification test

Clubs	Coefficient	T-Statistic
Club 1 + Club 2	-0.62	-9.80*
Club 2 + Club 3	-0.64	-9.91*
Club 3 + Club 4	-0.63	-22.01*
Club 4 + Club 5	-0.22	-3.03*
Club 5 + Club 6	-0.39	-3.76*
Club 6 + Club 7	-1.18	-26.62*
Club 7 + Group 8	-2.09	-8.65*

Notes: * denotes the rejection of the null hypothesis of convergence at 5% significance level.

To better interpret the results of the club merging test, we take the arithmetic average of the house prices included in each club (see Table 3 for the members of each club). These new indexes constructed by averages are presented in Figure 1. We can view that these indexes at the initial years of the sample are almost the same for all clubs. However, a different picture emerges towards the end of the sample, as the Clubs 3 and 4 have been in a correction period whilst all other clubs have an upward trend and house prices are increasing.

Figure 1. Arithmetic mean of house price indexes for each convergence club



Notes: Club1, Club2, Club3, Club 4, Club 5, Club 6 and Club 7 are the converged clubs, while Group 8 is the divergent one.

To sum up, we find that, although hedonic house prices do not convergence across regions, the Turkish housing market is subdivided into seven convergence clubs. Interesting features emerge on the basis of this convergence analysis. For instance, the regions of TR90 (Artvin, Giresun, Gümüşhane, Ordu, Rize, Trabzon), TRA2 (Ağrı, Ardahan, Kars, Iğdır), TRB1 (Bingöl, Elazığ, Malatya, Tunceli) and TRB2 (Van, Bitlis, Hakkari, Muş), which are economically less developed regions of Turkey, do not form a house price convergence club with any of the other 22 regions. In other words, there are four divergent regions suggesting that there is a strong evidence for heterogeneity in regional housing markets of Turkey. Regional heterogeneity in the Turkish housing market can be explained by economic (such as income, employment, etc.), social (such as migration, demography, etc.) and spatial factors.

When convergence clubs are examined, Club 1, for instance, involves TR10 (İstanbul) and TRC1 (Kilis, Adıyaman, Gaziantep), both of which have hosted great number of Syrian refugees since 2011. The number of Syrian refugees in Gaziantep, Kilis and İstanbul amounts to almost 1 million people. In other words, immigration of refugees to these cities seems to have implications over the dynamics of house price. On the other hand, there is a strong form of geographic neighborhood among club members especially for Club 2 and Club 3. Club 2 involves cities of the west coast of Turkey, i.e., İzmir, Aydın, Denizli and Muğla. Club 3 includes cities of the south coast, i.e., Antalya, Burdur, Isparta, Adana and Mersin. Hence, geographical proximity (e.g., regions in Clubs 5, 6 and 7) as well as coastal areas (regions in Clubs 2 and 3) appear to be the determining factors for the emergence of convergence clubs.

4. Conclusion

The main focus of this study is to examine whether there is a reduction in the cross-sectional dispersion of house prices over time. To that purpose, dynamic interactions of house prices across 26 regions of Turkey have been examined through the convergence analysis. The analysis covers the period from 2010Q1 to 2018Q4. Underlying motivation behind this research is to get implications of dynamics interlinkages of house prices which would be important for home buyers/sellers, investors, regulators and policymakers. We basically question whether a unique long-run equilibrium exists for house prices where all regions converge to. As to our knowledge, in the literature, this has been the first attempt to quantify the number of steady states in the Turkish housing market with a regional perspective.

The results of this paper provide no evidence of house price convergence across the 26 regions of Turkey. On the other hand, findings suggest that regional housing market can be characterized by the presence of multiple steady states in the Turkish housing market instead of a single steady state. We observe seven convergence clubs and one divergent club. In a nutshell, except the four regions within the divergent club, most of which are economically less developed regions of Turkey, all other regions show a pattern of converging to a common house price. In other words, these four regions provide a strong evidence for the heterogeneity in regional housing markets of Turkey.

Further research should focus on the possible causes of the observed heterogeneity in regional house prices. Improvements in the regional data for macroeconomic, social and demographic variables across regions will hopefully contribute to the research on the determinants of regional dispersion of house prices over time.

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