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RIPPLE EFFECT IN REGIONAL HOUSING AND LAND MARKETS IN IRAN: IMPLICATIONS FOR PORTFOLIO DIVERSIFICATION

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ABSTRACT. In recent years, real estate has become a very popular investment choice for Iranian investors due to several interrelated economic and political reasons. The purpose of this study is to find out how real estate investors can gain diversification benefits from investing within the real estate sector across provinces of Iran. We use semi-annual data from selected provinces of Iran over the period of 1993–2014 and apply univariate Lagrange multiplier unit root tests with one and two structural breaks to the ratio of the provincial to national house and residential land prices respectively. We find diversification benefit can be gained by investing in housing markets across provinces because house prices in half of the sample provinces tend to drift away from house prices in the rest of the country. In addition, our results show that it is difficult to create an adequately diversified portfolio in a residential land market because shocks to the residential land prices of provinces ripple out across the nation. These findings should be valuable to domestic and foreign investors who are interested in the Iranian real estate sector, especially after the lifting of several international economic sanctions.

KEYWORDS: Ripple effect; House prices; Land prices; Iran

1. INTRODUCTION

Real estate has been a very important asset class for Iranian households and investors (Gholipour, Bazrafshan 2012) as this asset class makes up a large fraction of household wealth and investors' portfolio. Real estate accounts for about 40 per cent of national capital stock[1] and more than 60 per cent of Iranian households were homeowners in 2011[2].

In recent years, real estate has become a more popular investment choice for Iranian investors due to several interrelated economic and political reasons. First, in the inflationary environment of Iran where the inflation rate, on average, was about 20 per cent over 2004–2014 (WDI 2015), real estate investment has been viewed as the best hedge against inflation for investors (Masron, Gholipour 2010). Second, the low real interest rate (–2.60 per cent, on average, over 2004–2014) has given investors another incentive to plough their cash into real estate. Third, the lack of well-developed financial markets and institutions has been another reason that most households' savings direct towards real estate. Fourth, the international pressure and economic sanctions on Iran over its disputed nuclear programme over the last decade has weaken the national currency (Rial) which encourages Iranians to turn to real estate to protect their savings (Nasseri 2012). Fifth, the majority of Iranian investors have very limited access to international financial and properties markets and thus have few international investing options due to economic and financial sanctions. The recent KOF Economic Globalization Index ranked the economy of Iran at 151st place out of 155 countries in 2015[3]. Likewise, the Index of Economic Freedom

[1] See http://tsd.cbi.ir/DisplayEn/Content.aspx (National Accounts, Net capital stock at constant prices)
[2] See page 31 at *2011 Iranian Population and Housing Census*, available at http://www.amar.org.ir/Portals/0/Files/abstract/1390/n_sarshomari90_2.pdf

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[3] See http://globalization.kof.ethz.ch/media/filer_public/2015/03/04/rankings_2015.pdf

published by the Heritage Foundation and The Wall Street Journal grouped the economy of Iran in "Repressed" category and ranked Iran at 171st place out of 178 countries in 2015. Sixth, in the absence of effective property tax (and ineffective taxing system in general[4]), the investment demands for real estate are very beneficial for investors. Seventh, real estate ownership has traditionally been very important for Iranian households because properties are considered as secure assets for them (Parliament Research Center 2008). The reasons mentioned above have contributed to the high level of real estate demand (particularly investment demand) in Iran. *Tarhe Jame Maskan* (project of gathering information on housing) in 2005 reported that about 40 per cent of total housing demands over the period of 1997–2002 were related to the investment demand for housing (Shams, Palizban 2010). Similarly, Alaedini and Fardanesh (2014) showed that around 40 to 60 per cent of the demand for housing is attributed to seeking an investment opportunity in Iran.

Given that real estate is such a key asset class and investors allocate a substantial proportion of their portfolios to direct properties, it is surprising that there is a lack of empirical research to study how investors can gain diversification benefits from investing within the real estate sector across provinces of Iran. In this paper, we apply univariate Lagrange multiplier (LM) unit root tests with one and two structural breaks to the ratio of the provincial to national house and residential land prices to test linkages between the different regional house and residential land prices. The analyses would help us ascertain how real estate investors can gain diversification benefits within the real estate sector across provinces. Our results show that it is difficult for investors to create an adequately diversified portfolio in land markets because there is a long-run convergence of Iranian provincial land prices. On the other hand, there is clear evidence that house prices are segregated between provinces which would result in a great scope for locational diversification. These findings should be valuable to domestic investors, portfolio managers and wealthy Iranians living abroad who are currently investing and interested in the Iranian real estate sector. Given that the average annual growth rate of house and land prices are similar across provinces of Iran (about 10 per cent) over the period of study (see Table 1), investors might be particularly interested in knowing how to gain maximum adjusted returns through risk reduction by diversification across provinces. Finally, our results would also be useful for foreign real estate investors who are looking for new business opportunities in an emerging economy which is experiencing periods without international economic sanctions and isolation[5]. In addition to practical implications for investors, an understanding of the nature of provincial property prices could also enrich the government's knowledge of how the provincial real estate markets work, thereby enabling the design and implementation of relevant policies.

Our study makes two contributions to the literature. Several studies have tested linkages between the different regional house prices (or ripple effect or price diffusion) in developed and Asian countries; such as the U.S. (e.g. Pollakowski, Ray 1997; Yunus, Swanson 2013), Australia (Luo *et al.* 2007), Finland (Oikarinen 2008), Malaysia (e.g. Hui 2010; Lean, Smyth 2013; Gholipour *et al.* 2016), Taiwan (Chien 2010), the U.K. (Meen 1999; Cook 2003, 2005; Tsai 2015; Montagnoli, Nagayasu 2015), South Africa (Balcilar *et al.* 2013) and North America and Europe (Yunus 2013). However, to our knowledge, there is a lack of empirical work on the ripple effect in the Middle Eastern property markets[6]. Therefore, our study contributes to the scant literature on the ripple effects in this region.

Furthermore, our research is among the first to examine whether there are differences in the existence of a ripple effect for both housing and residential land markets in Iran. Previous studies have mainly focused on the housing market al. ne. We include residential land markets in our analyses because land transactions have significantly increased over the last decade in Iran. The volume of land transactions was 137,477 units in 2006, with the volume climbing to 298,463 units in 2011, according to a series of surveys conducted

4 According to Doing Business 2014 data of the World Bank, Iran was ranked 139 out of 189 economies surveyed in 2014 in terms of Paying Taxes. See http://www.doingbusiness.org/data/exploreeconomies/iran/#paying-taxes

5 Recently, Iran hosts several international exhibition of real estate to attract more foreign investors to its real estate sector. See, for example, http://iranpropertyexpo.com/
It should be noted that foreigners can own or lease property if the property is for commercial or industrial use, or for a personal residence. In the latter case, the foreigner must normally be resident in Iran. Non-residents (who are visiting Iran frequently) are also allowed to have a residential property after obtaining approvals from the Ministry of Foreign Affairs. See http://www.globalpropertyguide.com/Middle-East/Iran and http://rc.majlis.ir/fa/law/show/115763a

6 It is mainly because of unavailability of property price time series in these countries.

by Statistical Centre of Iran[7]. This clearly shows that residential land has become an important asset class for Iranian investors and it is not a thin trading market. This is mainly due to the fact that investors are able to change the residential land use (after acquisition of land) for different purposes depending on business opportunities in various economic sectors. This is because land use regulations are not well-developed and there is a substantial level of corruption among public officials who should implement the existing land use regulations (Sodaei 2015).

The remainder of this article is organized as follows. Section 2 briefly reviews the relevant literature on linkages between regional property markets (or the ripple effect). Section 3 provides a description of the data. Section 4 discusses the methodology. Section 5 presents empirical results, and the section 6 contains concluding remarks.

2. A BRIEF LITERATURE REVIEW

Since the main purpose of this study is to understand the linkages between the different regional house and land prices, we briefly review the studies that provide insights into price diffusion in regional property markets (or the ripple effect). According to Meen (1999), the propensity for house prices to rise first in a region of the country during an upswing and to gradually spread out to the rest of the country over time is known as the "ripple effect". He argued that the ripple effect occurs because of migration, equity transfer, spatial arbitrage and spatial patterns in the determinants of house prices.

Several studies in high-income economies and Asian countries have used various econometric methods to test for the ripple effect in regional house prices. The first strand of research uses cointegration and Granger causality tests and generally showed that house price shocks in one area can cause shocks in other areas (e.g. Alexander, Barrow 1994; Oikarinen 2008). The second strand of research beginning with Meen (1999) has used stationarity or unit root tests with the ratio of regional to national house prices to test for ripple effect between regions. Meen (1999) argued that if the ripple effect exists, the ratio between each regional house price and the national house price will be stationary. In other words, the ripple effect implies that, in the long-run, the ratio of house prices in a given region to the national house prices should be constant (Lean, Smyth 2013). The majority of studies using unit root tests with structural breaks provided support for convergence of regional house prices (e.g. Balcilar *et al.* 2013; Lean, Smyth 2013). Moreover, both strands of research indicated that the ripple effect are generally from the more developed and industrialized regions than other regions.

Empirical studies on the linkages between the different regional property markets have used their results to provide practical implications for real estate investors. For instance, the fact that they are analysing the manner of long-run movements in regional house prices is a very important issue for portfolio diversification. According to Modern portfolio theory (Markowitz 1952) the diversification benefits hold only if the assets in the portfolio are not perfectly correlated. In other words, investors can diversify away the risk of investment (unsystematic risks) by reducing the correlation between the returns from the assets in their portfolio.

In a study on the relationship between house prices in Malaysia's major economic regions and Singapore's house prices, Gholipour *et al.* (2016) suggested that the inclusion of Penang (a state in Northern part of Malaysia) and Singapore in an investment portfolio would help real estate investors to diversify risks of housing investments in South East Asia region. This is because Penang house prices have a negative long-run relationship with Singapore house prices. Lean and Smyth (2013) showed that, due to regional house prices convergence and housing market integration in Malaysia, market segmentation is very limited for investors. In addition, Chen *et al.* (2011), Yunus and Swanson (2013), and Yunus (2013), have used their analyses of links between housing markets to provide practical implications for portfolio managers in Taiwan, the U.S., and developed economies, respectively.

In sum, since Iranian investors allocate a substantial proportion of their portfolios to the real estate sector and there is limited literature on the relationship between regional housing markets in the Middle East, our study provides some valuable insights.

3. DATA

Iran is a non-Arab country in the Middle East, bordered by Armenia, Azerbaijan, Turkmenistan, Afghanistan, Pakistan, Iraq, and Turkey. The Caspian

[7] see http://www.amar.org.ir/Portals/0/Files/abstract/1391/ch_bongah_91.pdf

Fig. 1. Iran's political map

Source: Maps of World; Available at http://www.mapsofworld.com/iran/iran-political-map.html

Sea borders Iran in the north, and the Persian Gulf and Gulf of Oman are situated to its south. Internationally, it came into existence in 1935, before which it was known only to the Western world as *Persia*. Iran is the 18th largest nation in the World and the second-largest in the Middle East (Maps of World 2015). It is the world's 17th most populous nation with 79 million inhabitants. It was administratively divided into 31 provinces (*Ostans*) in 2014. Each province is governed from the capital (*Markaz*) of that province. Iran's political map is illustrated in Figure 1. It shows the international boundary, provincial boundaries with their capitals and national capital.

This paper uses semi-annual residential house and residential land prices data covering the period from 1993 to 2014. The choice of the data period for the empirical analysis is based on the availability of a data series. Information on average house prices per square meter (1000 Iranian Rial[8]) and average residential land prices per square meter (1000 Iranian Rial) were taken from the *Statistical Centre of Iran*. All house and land prices are log-transformed before the analysis. It should be noted that data for house and land prices are gathered from the capital city of each province.

In this study, we use data for 18 out of 31 provinces due to unavailable data or several missing values for another 13 provinces. The selected provinces have different geographical positions and economic development. The sample provinces are Khuzestan, Markazi, Ardabil, Esfahan, Qom, Golestan, Hamedan, Alborz, Kerman, Kermanshah, Razavi Khorasan, West Azerbaijan, Qazvin, Gilan, Fars, East Azerbaijan, Yazd and Zanjan. It should be noted that Tehran province is not included in our analysis because its data has many missing values. However, to a large extent, we can observe house and land prices in Tehran province by looking at Alborz province, introduced in 2010 as the 31st province of Iran and formed by dividing Tehran in two.

Table 1 presents the average growth rate of house and land prices in provinces over the period 1993–2014. As shown in Table 1, among the sample provinces, Hamedan (12.78) and Yazd (8.43) provinces experienced the highest and lowest

[8] One U.S. dollar almost equals to Iranian Rial 30,240 in March 2016.

Table 1. Average growth of house and land prices per square meter (1000 Iranian Rial) over 1993S1–2014S1

Province	Average growth house prices (%)	Average growth land prices (%)
Khuzestan	9.04	11.40
Markazi	10.96	10.29
Ardabil	10.19	10.71
Esfahan	10.62	9.16
Qom	11.86	11.55
Golestan	9.88	9.49
Hamedan	12.78	10.11
Alborz	10.32	9.48
Kerman	8.81	8.64
Kermanshah	10.14	10.15
Razavi Khorasan	10.65	9.71
West Azerbaijan	9.41	9.67
Qazvin	9.62	10.03
Gilan	9.57	11.73
Fars	9.25	10.91
East Azerbaijan	10.30	9.45
Yazd	8.43	9.94
Zanjan	10.76	11.81
Iran (including all provinces)	9.66	10.79

Source: Statistical Centre of Iran.

house price growth, respectively. Regarding land price growth, Zanjan (11.81) and Kerman (8.64) recorded the highest and lowest rate, respectively. In addition, it can be observed that average national land prices grew faster than average national house prices. This is primarily owing to the supply of land being more inelastic (due to limitation of land) than supply of houses in Iran in the short-run and long-run. Therefore, any increase in demand for land and houses would raise land prices more than house prices. Furthermore, in recent years, demand for land at a national level has significantly increased. This is mainly due to the fact that after acquisition, land investors can change the land's use for different purposes, depending on business opportunities in various economic sectors. Since Iran's land use regulations are underdeveloped and a substantial level of corruption exists among public officials, the existing land use regulations aren't sufficiently implemented (Sodaei 2015).

While the average national land price grew faster than average national house price, in some provinces such as Esfahan and Hamedan, house prices grew much faster than land prices over the period of our study. This warrants an independent empirical study to determine why provinces of Iran experience different growth rates in housing and land markets. For instance, we deduce that growing house prices in Hamedan can be attributed to a strong population and tourism boom (due to favourable climate), speculative demand for housing, and very limited land supply (because of surrounding mountains). In contrast, speculative demand for housing, higher households' income (influenced by higher level of industrial production and employment) and very limited land supply (due to historical buildings and World Heritage sites) have played significant roles in explaining housing price growth in Esfahan.

4. ECONOMETRIC METHODOLOGY

To examine the convergence or divergence in provincial house and land prices in Iran we use the univariate Lagrange multiplier (LM) unit root tests with one and two structural breaks developed by Lee and Strazicich (2003, 2004). This technique is among the most efficient methods that are used to examine the ripple effect and long-run divergence or convergence in regional/national house prices. The approach has been used by several researchers in recent years (e.g. Balcilar *et al.* 2013; Chien 2010; Lean, Smyth 2013). The main reason to apply the univariate LM unit root tests with one and two structural breaks is because there were several disruptors in the Iranian real estate market over the period of our study (1993–2014). These were mainly caused by presidential elections, government housing policies and international sanctions.

The LM univariate unit root test is applied to the ratio of province to the national (or aggregate) house and land prices to examine the ripple effect in Iranian housing and land markets. If the ratio of province prices to the national price is stationary it means that prices in provinces eventually reach a steady path driven by a common process. In other words, regional/national price ratios are assumed to be stationary under the ripple effect, reverting to an underlying mean value (Cook 2005). As Meen (1999) indicates, the ripple effect implies a long-run constancy, or stationarity, in the ratio of house prices in different regions to the national price. If a ripple effect exists, then the ratio between each regional price and the national house price is stationary (Meen 1999; Cook 2005).

Let the data generating process: $y_t = \delta' X_t + e_t$, $e_t = \beta e_{t-1} + \varepsilon_t$. Here, y_t is the ratio of province to national house prices in period t, X_t consists of exogenous variables and ε_t is an error term with classical properties.

Lee and Strazicich (2004) developed two forms of the LM unit root test with one structural break, namely models A and C. Models A and C differ in terms of scope: whether the break is in the intercept or if it includes both the intercept and slope of the price ratio. Model A allows for one structural break in the intercept and can be described by

$X_t = [1, t, D_t]'$, where $D_t = 1$ for $t \geq T_B + 1$, and zero otherwise, T_B is the date of the structural break, and $\delta' = (\delta_1, \delta_2, \delta_3)$. Model C allows for one break in both the intercept and slope of the price ratio and can be described by

$X_t = [1, t, D_t, DT_t]'$, where $DT_t = t - T_B$ for $t \geq T_B + 1$, and zero otherwise.

Lee and Strazicich (2003) developed a version of the LM unit root test to accommodate two structural breaks. These are commonly known as models AA and CC. They differ in terms of whether the break is restricted to the intercept or extends to the intercept and slope of the price ratio. Model AA, as an extension of model A, allows for two breaks in the intercept and is described by

$X_t = [1, t, D_{1t}, D_{2t}]'$ where $D_{jt} = 1$ for $t \geq T_{Bj} + 1$, $j = 1,2$, and 0 otherwise. T_{Bj} denotes the date when the structural breaks occur. Model CC, which is as an extension of model C, incorporates two structural breaks in the intercept and the slope and is described by

$X_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $DT_{jt} = t - T_{Bj}$ for $t \geq T_{Bj} + 1, j = 1,2,$ and 0 otherwise.

The LM unit root test statistic is obtained from the following regression:

$$\Delta y_t = \delta' \Delta X_t + \phi \bar{S}_{t-1} + \mu_t$$

where: $\bar{S}_t = y_t - \hat{\psi}_x - X_t \hat{\delta}_t$, $t = 2,...,T$; $\hat{\delta}$ are coefficients in the regression of Δy_t on ΔX_t; $\hat{\psi}_x$ is given by $y_t - X_t \delta$; and y_1 and X_1 represent the first observations of y_t and X_t respectively.

The most important parameter is $\varnothing$. The LM test statistic is the t-statistic for testing the unit root null hypothesis that $\varnothing = 0$. The location of the structural break is determined by selecting all possible structural break points for the minimum t-statistic. The search is carried out over the trimming region (0.1T, 0.9T), where T is the sample size.

First, we compare model A and model C. Sen (2003a) argued that model C is preferable to model A when the break date is treated as unknown. Further evidence from Monte Carlo simulations, reported in Sen (2003b), show that model C will yield more reliable estimates of the break point than model A. Hence, between model A and model C we focus on the results of the latter.

While Sen (2003a, 2003b) suggested that model C is preferable to model A in the one-break case, no such clear-cut claims can be made in the two-break case. We prefer the results from model CC over model AA because model CC is the more general case and has the advantage that it encompasses model AA. Comparing model C with model CC, as a rule of thumb, the two-break model should be preferred if the second break in the intercept and slope are both statistically significant.

5. EMPIRICAL RESULTS

Table A in the Appendix presents the results for the LM unit root test with one break in the intercept (model A). The results show that, for house prices, the unit root null is rejected for 9 of 18 provinces. For land prices, the unit root null is rejected for 15 of 18 provinces. Table B in the Appendix shows the results for the LM unit root test with one break in the intercept and slope (model C). As can be seen, there is more evidence of stationarity for house and land prices. Model C shows that, for house prices, the unit root null is rejected for 12 of 18 provinces; and for land prices, the unit root null is rejected for all provinces. In fact, model C suggests much more evidence of a ripple effect. Following Sen (2003 a, b) and Lean and Smyth (2013), between model A and model C, we focus on the results of the latter. Based on model C, there is a clear evidence in supporting convergence or the ripple effect for land prices across provinces of Iran and, to a lesser degree, in house prices.

Table 2 presents the results for model AA. Similar to model A, with two breaks in the intercept there is also less evidence of stationarity for house and land prices. For house prices, model AA suggests almost the same number of rejections as model A (8 of 18 provinces) and for land prices, the unit root null is rejected for 17 of 18 provinces. Table 3 reports the findings for model CC. Compared to model AA, model CC contains more stationarity for house prices (9 of 18 provinces) as well as land prices (all provinces). Following Lean and Smyth (2013), we prefer the results from model CC over model AA, given that model CC is the more general case and has the advantage that it encompasses model AA.

Table 2. Univariate LM unit root test with two breaks in the intercept (Model AA)

House prices	TB_1	TB_2	k	S_{t-1}	B_{t1}	B_{t2}
Khuzestan	2001S1	2009S1	2	–0.4106 (–3.3529)	0.1818*** (2.7325)	–0.1719*** (–2.5206)
Markazi	2006S1	2007S1	2	–0.1737 (–2.3836)	0.2333*** (3.7442)	–0.1529*** (–2.5392)
Ardabil	1996S2	1998S1	0	–0.9437*** (–5.8264)	–0.0708 (–1.0311)	–0.0599 (–0.8723)
Esfahan	2000S1	2002S2	0	–0.2444 (–2.3000)	–0.0987** (–1.7019)	–0.0589 (–0.9972)
Qom	2000S1	2006S1	0	–0.2807 (–2.4906)	–0.1204 (–1.2917)	–0.1496* (–1.5468)
Golestan	2004S2	2009S1	2	–0.2843 (–2.9882)	–0.2431*** (–3.4453)	–0.2011*** (–2.6226)
Hamedan	2002S1	2004S1	0	–0.7128*** (–4.5871)	–0.0048 (–0.0305)	–0.2036 (–1.2645)
Alborz	2002S2	2006S1	2	–0.3166 (–3.4217)	–0.0598 (–1.1594)	–0.1359*** (–2.5934)
Kerman	2000S1	2002S1	0	–0.3300 (–2.7400)	0.2034* (1.5244)	0.2436** (1.8320)
Kermanshah	1996S1	2004S1	0	–0.8816*** (–5.4731)	–0.1600** (–2.4056)	0.1884*** (2.6056)
Razavi Khorasan	1995S1	2004S2	0	–0.4677 (–3.4056)	0.1456*** (2.5066)	–0.1796*** (–3.1063)
West Azerbaijan	2001S1	2008S2	2	–0.4609** (–4.2334)	0.0964** (1.7390)	0.1464** (2.3967)
Qazvin	1995S1	1996S1	0	–0.6701** (–4.3756)	0.0610 (1.0000)	0.0220 (0.3605)
Gilan	2000S1	2001S2	0	–1.0066*** (–6.2050)	–0.0583 (–0.7478)	–0.0869 (–1.1181)
Fars	1996S2	2007S2	0	–0.5257* (–3.6811)	–0.0596 (–0.6785)	0.1078 (1.2045)
East Azerbaijan	2002S1	2008S2	0	–0.4079 (–3.1200)	–0.0968** (–1.7024)	0.1726*** (2.9763)
Yazd	2006S1	2007S2	0	–0.3785 (–2.9781)	0.1603*** (2.6597)	0.1238** (2.0617)
Zanjan	2007S2	2012S1	0	–0.8707*** (–5.4128)	–0.0593 (–0.7256)	0.0209 (0.2583)
Land prices						
Khuzestan	1999S2	2000S2	0	–1.0653*** (–6.5808)	0.4225** (2.2943)	0.3715** (2.0541)
Markazi	1995S2	1998S1	0	–0.5882** (–3.9788)	–0.4222*** (–2.5550)	0.0577 (0.3547)
Ardabil	2005S1	2009S1	0	–0.7936*** (–4.9996)	–0.3071** (–1.9111)	0.3323** (2.1158)
Esfahan	2005S2	2012S1	0	–0.7874*** (–4.9676)	0.0172 (0.1117)	–0.1135 (–0.7616)
Qom	1999S2	2000S2	0	–0.9355*** (–5.7787)	–0.1628 (–0.4307)	–0.3169 (–0.8382)
Golestan	2007S2	2008S2	0	–0.6297** (–4.1787)	–1.0209*** (–7.1946)	0.5296*** (3.7297)
Hamedan	2001S2	2007S2	0	–0.9646*** (–5.9497)	0.1910 (1.1019)	–0.6203*** (–3.4895)
Alborz	1997S2	2001S1	0	–0.7288*** (–4.6675)	–0.0557 (–0.3629)	0.2073* (1.3559)
Kerman	2000S1	2007S2	0	–0.4368 (–3.2587)	0.2367 (1.2282)	0.6811*** (3.5339)
Kermanshah	1996S1	2004S1	0	–1.0097*** (–6.2245)	0.0553 (0.3602)	0.0792 (0.5018)
Razavi Khorasan	2008S2	2009S2	0	–0.5559* (–3.8245)	–0.2327* (–1.4195)	–0.1877 (–1.1716)
West Azerbaijan	1995S1	2004S2	0	–0.6056** (–4.0623)	–0.0900 (–0.4786)	–0.5760*** (–3.0688)
Qazvin	1999S2	2005S2	0	–0.8244*** (–5.1621)	0.2165* (1.3697)	0.3700** (2.3911)
Gilan	2002S2	2008S2	0	–0.7432*** (–4.7404)	0.0987 (0.3698)	–0.1620 (–0.6062)
Fars	2004S1	2007S2	0	–1.0581*** (–6.5334)	–0.2758* (–1.6201)	0.5593*** (3.2237)
East Azerbaijan	2001S1	2004S1	0	–0.9212*** (–5.6965)	0.0314 (0.2067)	–0.1849 (–1.1873)
Yazd	2006S1	2008S1	0	–0.7162*** (–4.6043)	0.2826* (1.6692)	0.1102 (0.6354)
Zanjan	1999S2	2008S2	0	–1.0918*** (–6.7591)	0.4432*** (2.7280)	0.1571 (0.9527)

Notes: TB_1 and TB_2 are the dates of the structural breaks; k is the lag length; S_{t-1} is the LM test statistic; B_{t1} and B_{t2} are the dummy variables for the structural breaks in the intercept. Figures in parentheses are t-values. Critical values for the LM test at 10%, 5% and 1% significance levels are –3.504, –3.842 and –4.545 respectively. * , ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Table 3. Univariate LM unit root test with two breaks in the intercept and trend (Model CC)

House prices	TB_1	TB_2	K	S_{t-1}	B_{t1}	B_{t2}	D_{t1}	D_{t2}
Khuzestan	1999S2	2008S2	2	–0.7194	–0.0220	0.2214***	0.1144***	–0.1706***
				(–4.7213)	(–0.3249)	(3.4028)	(3.5234)	(–4.4949)
Markazi	1999S2	2007S1	2	–0.5175	0.0763	–0.3483***	0.0817**	0.1087***
				(–3.6308)	(1.1386)	(–4.1153)	(2.2874)	(3.1029)
Ardabil	1996S2	2008S2	0	–1.0307***	–0.0196	0.0536	–0.0826***	0.0475**
				(–6.1872)	(–0.2835)	(0.7635)	(–2.6255)	(1.7751)
Esfahan	1996S2	2006S1	2	–1.1904*	–0.0967**	–0.0530	0.0428**	–0.0501**
				(–5.4034)	(–1.7663)	(–0.9888)	(1.6927)	(–2.3047)
Qom	2006S2	2009S2	1	–0.8807	–0.1985**	0.1114*	0.1413***	–0.2580***
				(–5.2227)	(–2.2895)	(1.3272)	(3.5780)	(–4.2488)
Golestan	2000S2	2007S2	1	–0.8713	–0.0553	–0.0553	–0.0955***	0.1895***
				(–5.0236)	(–0.8594)	(–0.7789)	(–3.9012)	(4.5809)
Hamedan	2004S1	2007S2	2	–1.7671***	–0.6967***	–0.0020	0.6552***	–0.5524***
				(–8.5523)	(–5.2726)	(–0.0160)	(7.9239)	(–7.1146)
Alborz	1994S2	2004S1	2	–0.7732**	0.0449	0.0200	0.1144***	–0.0853***
				(–5.7989)	(1.0116)	(0.4362)	(2.4353)	(–3.7988)
Kerman	2000S1	2007S2	2	–0.8223	0.1955**	0.7555***	0.0587*	–0.1177***
				(–4.8578)	(1.9215)	(6.4174)	(1.4108)	(–2.9416)
Kermanshah	2000S2	2005S1	0	–1.0984***	–0.1902***	–0.0041	0.1931***	–0.1550***
				(–6.6223)	(–2.7689)	(–0.0639)	(5.1889)	(–4.3779)
Razavi Khorasan	1995S2	2004S2	0	–0.6660	–0.0340	–0.1773***	–0.0417*	0.0080
				(–4.2392)	(–0.6070)	(–3.1633)	(–1.4981)	(0.4349)
West Azerbaijan	2006S1	2009S2	2	–0.5496	0.0963*	–0.1474**	–0.0539*	0.0526*
				(–4.9139)	(1.4636)	(–2.2336)	(–1.5378)	(1.3351)
Qazvin	1997S1	2005S2	2	–1.5600**	0.0452	–0.0563	0.0278	0.0824***
				(–6.0455)	(0.8395)	(–0.9910)	(1.0242)	(3.6747)
Gilan	1995S1	2001S2	0	–1.1301***	–0.1529**	–0.0819	–0.0279	–0.0621**
				(–6.8387)	(–1.9780)	(–1.0883)	(–0.6548)	(–2.2373)
Fars	2003S1	2007S1	0	–0.9022*	–0.1086**	0.3865***	0.1164***	–0.0072
				(–5.4394)	(–1.7821)	(6.7055)	(3.0351)	(–0.2648)
East Azerbaijan	2001S2	2008S2	1	–0.9886	0.1353**	0.2427***	–0.1123***	0.0761***
				(–5.0940)	(2.3271)	(4.3242)	(–4.1779)	(3.2481)
Yazd	1999S2	2006S1	0	–0.5474	0.1493***	0.1234**	–0.0105	0.0941***
				(–3.6833)	(2.4785)	(2.0402)	(–0.4523)	(3.2951)
Zanjan	1995S1	2000S1	0	–1.0314***	0.1731**	–0.0037	0.0116	0.1023***
				(–6.1912)	(2.1370)	(–0.0474)	(0.2531)	(3.0993)
Land prices								
Khuzestan	1998S1	1999S2	0	–1.2043***	0.3329*	0.2296*	–0.3143**	0.2151*
				(–7.3818)	(1.5560)	(1.3246)	(–2.2058)	(1.6454)
Markazi	1995S1	1999S2	0	–1.1689***	0.2778**	0.0717	–0.2760***	0.3515***
				(–7.1155)	(1.9002)	(0.5422)	(–3.0349)	(4.7464)
Ardabil	1998S1	2004S2	0	–0.9307*	0.0274	–0.5143***	–0.0811	0.1859***
				(–5.5975)	(0.1820)	(–3.5373)	(–1.2823)	(3.0048)
Esfahan	1998S1	1999S2	0	–0.9775**	0.3519**	0.0010	–0.3708***	0.4347***
				(–5.8666)	(1.9435)	(0.0067)	(–3.0527)	(3.4666)
Qom	1998S1	1999S2	0	–1.7620***	–1.7752***	0.2155	1.7687***	–2.0571***
				(–16.3274)	(–7.0803)	(1.1649)	(9.7763)	(–10.9930)
Golestan	2007S1	2009S1	1	–1.4715***	0.8226***	–0.3312**	–0.9257***	0.7954***
				(–7.9083)	(4.2204)	(–1.8051)	(–7.0138)	(6.1137)
Hamedan	1998S2	2007S2	0	–1.0700***	–1.2178***	–0.5151***	0.6311***	–0.4382***
				(–6.4359)	(–6.9668)	(–3.2887)	(5.8645)	(–5.0076)
Alborz	1998S1	2003S1	0	–0.9198*	0.0175	0.0838	–0.1132*	–0.0112
				(–5.5364)	(0.1136)	(0.5630)	(–1.5644)	(–0.1940)
Kerman	1999S2	2007S2	0	–0.9086*	–0.2562*	0.6053***	0.4756***	–0.1405**
				(–5.4747)	(–1.4584)	(3.4965)	(4.5099)	(–2.0457)
Kermanshah	1997S2	2004S1	0	–1.1102***	0.1110	0.0213	–0.1565**	–0.0391
				(–6.7018)	(0.7174)	(0.1397)	(–2.2166)	(–0.7239)
Razavi Khorasan	1998S2	2009S2	1	–1.0513**	–1.1777***	0.1002	0.4092***	–0.6382***
				(–6.2445)	(–8.3714)	(0.7584)	(4.9524)	(–5.7829)
West Azerbaijan	2000S2	2008S2	0	–1.0166**	0.1362	0.1565	0.0921*	0.1065*
				(–6.1005)	(0.7859)	(0.8878)	(1.4474)	(1.5388)
Qazvin	2003S1	2005S2	0	–0.9247*	–0.0043	0.3178**	–0.0677	0.1687**
				(–5.5641)	(–0.0254)	(2.0641)	(–0.8255)	(1.9157)
Gilan	2004S1	2007S2	0	–1.3311***	–0.7823***	0.4979***	0.8410***	–0.9119***
				(–8.4643)	(–3.3737)	(2.4404)	(6.1006)	(–6.2431)
Fars	2001S2	2007S1	0	–1.0919***	–0.1783	0.4173***	0.0602	0.0367
				(–6.5794)	(–1.0245)	(2.4323)	(0.8733)	(0.5318)
East Azerbaijan	2002S2	2006S2	0	–0.9653**	–0.2161*	–0.4476***	0.0203	0.0935*
				(–5.7952)	(–1.4409)	(–3.0782)	(0.3268)	(1.3751)
Yazd	2003S1	2009S1	0	–1.0424**	0.1396	0.0052	–0.2009***	0.2430***
				(–6.2601)	(0.8553)	(0.0319)	(–2.9118)	(2.8608)
Zanjan	1999S2	2004S2	0	–1.2085***	0.4662***	–0.2528*	0.1043*	0.1313**
				(–7.4141)	(2.8356)	(–1.5791)	(1.5168)	(2.0308)

(Continued)

λ_2	0.4			0.6			0.8		
λ_1	1%	5%	10%	1%	5%	10%	1%	5%	10%
(Continued)									
0.2	–6.16	–5.59	–5.27	–6.41	–5.74	–5.32	–6.33	–5.71	–5.33
0.4	–	–	–	–6.45	–5.67	–5.31	–6.42	–5.65	–5.32
0.6	–	–	–	–	–	–	–6.32	–5.73	–5.32

Notes: TB_1 and TB_2 are the dates of the structural breaks; *k* is the lag length; S_{t-1} is the LM test statistic; B_{t1} and B_{t2} are the dummy variables for the structural breaks in the intercept. D_{t1} and D_{t2} are the dummy variables for the structural breaks in the slope. Figures in parentheses are t-values. λ_j denotes the location of breaks. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Comparing model C with model CC, the two-break model should be preferred if the second break in the intercept and slope are both statistically significant. Using this criterion, we summarise our preferred results in Table 4. In terms of house prices, the unit root null is rejected for half of the provinces, whereas in the case of land prices, the unit root null is rejected for all provinces.

These findings, first, imply that the ratio of provincial to national house prices is non-stationary for half of the provinces. This is indicative of significant segmentation, with house prices in 50 per cent of the sample provinces tending to drift away from house prices in the rest of the country, which would result in a great scope for locational diversification. In other words, house prices in half of the provinces do not have a tendency to return to an underlying equilibrium in the long-run despite possible departures from it over the shorter term. This result is inconsistent with a large number of studies in the developed and open economies which found that benefits from housing portfolio diversification across regions is very limited due to regional house prices convergence and housing market integration (e.g. Chien 2010; Yunus, Swanson 2013; Lean, Smyth 2013). The majority of previous studies have been conducted in relatively efficient market economies (e.g. the U.S., the UK, Australia and Finland) where the level of transparency in the real estate market is high. According to the Jones Lang LaSalle's report in 2014 (JLL 2014), for example, the UK, the U.S. and Australia are the world's most transparent markets. These markets have readily available information and operate in a fair and consistent manner. Thus, it is not surprising to observe regional house price convergence in such transparent markets. In contrast, Iran's housing market is not clearly organized or operating in a legal and regulatory framework. It is not characterized by a consistent approach to the enforcement of published rules and planning regulations, and has relatively high information costs (e.g. Bagheri 2015).

We also observe that house price convergence is relatively more apparent in provinces that receive more domestic tourists such as Esfahan, Fars, Gilan and Hamedan. One possible explanation for this is that visiting a destination and learning about the host location's house prices may reduce asymmetric information of house prices across provinces, resulting in house price convergence over time. In addition, consistent with Meen (1999), the ripple effect occurs more in provinces with a larger domestic immigrant population such as Alborz, Esfahan, Gilan and Qazvin. On the other hand, provinces exhibiting divergent tendencies in the Iranian housing markets also have slower growth in house prices. Such provinces include Kerman, Khuzestan, West Azerbaijan and Yazd. Furthermore, the provinces of Kerman, Markazi, Qom and Yazd are located in dry areas, with shortages of rainfall, and are at risk of droughts. Khuzestan (which produces most of Iran's oil) and Markazi have also been classified as unhealthy by the World Health Organization[9], citing air pollution levels that exceed safe limits. Therefore, these provinces may not be attractive places for long-term residency, explaining their house prices having the tendency to fall short of house prices in the rest of the country.

It is also observed that economic development and population are not important factors for integration (convergence) or segmentation (divergence) in the housing market. For example, Esfahan and Razavi Khorasan are among the most developed provinces, though Esfahan's house prices tend toward convergence while Razavi Khorasan's house prices tend to drift away from house prices in the rest of the country. Regarding population, Yazd and Zanjan are among the least populous provinces but Yazd's house prices are non-stationary whereas Zanjan's house prices are stationary.

[9] See http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

Secondly, results in Table 4 show that the ratios of provincial to national land prices are stationary for all provinces. This suggests that land price shocks from a province of Iran ripple out and significantly influence land price changes in the rest of the country. Therefore, there is no diversity across provinces within the land market which would result in no scope for locational diversification. One possible justification for this is that Iran's land market is by no means thin (unlike most developed countries, see Oikarinen 2014), and as mentioned earlier, its trading volume has significantly increased over the last decade.

Table 4. Preferred results based on the univariate LM unit root tests

	House prices	Land prices
Khuzestan	NS	S
Markazi	NS	S
Ardabil	S	S
Esfahan	S	S
Qom	NS	S
Golestan	NS	S
Hamedan	S	S
Alborz	S	S
Kerman	NS	S
Kermanshah	S	S
Razavi Khorasan	NS	S
West Azerbaijan	NS	S
Qazvin	S	S
Gilan	S	S
Fars	S	S
East Azerbaijan	NS	S
Yazd	NS	S
Zanjan	S	S

Notes: NS = Non-stationary; S = Stationary.

The structural breaks in the Iranian real estate market were mainly caused by presidential elections, government housing policies and international sanctions over the period of our study. The empirical results illustrate that the development of Iran's property market had two structural breaks. The first set of breaks is associated with presidential elections in 1997 and 2001 and their subsequent years (1998–1999; 2002–2003 respectively). In 1997, Mohammad Khatami (a reformist president) won the presidential election with 70 per cent of the vote, beating the conservative ruling elite for the first time since 1979. His victory caused a significant uncertainty for investors because many of his reformist initiatives (e.g. boost privatisation, measures to tackle unemployment, greater freedom of expression) were blocked by the country's conservative institutions (BBC 2009). A similar scenario repeated after his victory in 2001.

The second set of structural breaks occurred in 2007–2009 and 2012–2013. In 2007, the Mehr Housing Plan (Maskan-e Mehr) was introduced by the sixth President of Iran, Mahmoud Ahmadinejad. Under this plan, property developers offer free land in return for building cheap residential houses for first-time buyers on 99-year lease contracts. The government has commissioned agent banks to offer loans to property developers, who can then prepare the land and begin construction projects (Euromonitor International 2013; Gholipour, Farzanegan 2015). The structural breaks in 2012–2013 came out of very tight economic sanctions against Iran over its nuclear programme[10]. For example, in January 2012, the U.S. imposed sanctions on Iran's central bank, the main clearing-house for its oil export profits. In July 2012, the European Union boycott of Iranian oil exports came into effect[11] (BBC 2015).

6. CONCLUSIONS AND IMPLICATIONS

The purpose of this paper is to offer some input that will help determine a diversification strategy for a real estate portfolio in Iran. We examine the stationarity properties of provincial house and residential land prices with semi-annual data covering 1993–2014 to find out whether the provincial house and land prices in Iran are integrated or segmented. As far as we know, this is the first study that uses univariate LM unit root tests with one and two structural breaks to analyse ripple effect in a Middle Eastern property market.

Our analysis shows strong overall evidence of provincial land price convergence in Iran's land market. Therefore, it is difficult to create an adequately diversified portfolio in the country's land market. However, diversification benefits can be gained by investing in housing markets across provinces, as half the sample provinces tended to drift away from house prices in the rest of the country. Based on these results and also considering geographical proximity (which can reduce the cost of property management), we suggest the following examples of diversification in housing markets across the provinces of Iran: (1) investors may include houses in Ardabil, West Azerbaijan, East Azerbaijan and

[10] For more details on the effects of sanctions on housing industry in Iran see Gholipour and Farzanegan (2015).

[11] For more details on Iran nuclear issues see http://www.bbc.com/news/world-middle-east-15983302

Zanjan in one basket; (2) houses in Golestan, Qom, Alborz and Gilan in one basket; (3) houses in Khuzestan, Markazi and Esfahan in one basket.

Finally, our results have important implications for policymakers. Since increases to land prices in certain provinces of Iran can potentially spread to other provinces, policymakers who observe episodes of very rapid land price growth in a province should attempt to restrain local land price inflations before they start spreading. On the other hand, it seems that house price increases remain a local phenomenon and do not ripple out across the country quickly. Therefore, policymakers may not give a significant weight to house prices in the rest of country when their interests lie are modelling and forecasting provincial house prices and paying more attention to local variables such as economic activities, employment and housing stocks.

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Appendix

Table A. Univariate LM unit root test with one break in the intercept (Model A)

House prices	TB	K	S_{t-1}	B_t
Khuzestan	2001S1	0	–0.2094 (–2.2165)	0.1918*** (2.7220)
Markazi	2007S1	2	–0.1606 (–2.2718)	–0.2382*** (–3.0211)
Ardabil	1996S2	0	–0.8240*** (–5.4248)	–0.0488 (–0.7008)
Esfahan	2002S2	0	–0.2025 (–2.1754)	–0.0688 (–1.1864)
Qom	2004S2	2	–0.2067 (–2.0498)	–0.2594*** (–2.9559)
Golestan	2009S1	2	–0.2113 (–2.4514)	–0.1840** (–2.3009)
Hamedan	2005S2	0	–0.6631*** (–4.5640)	0.1934 (1.2591)
Alborz	2006S1	2	–0.2592* (–3.3039)	–0.1303*** (–2.5974)
Kerman	2000S1	0	–0.2803 (–2.6163)	0.1661 (1.2569)
Kermanshah	1996S1	0	–0.7831*** (–5.1989)	–0.1641*** (–2.4804)
Razavi Khorasan	2004S2	0	–0.3349 (–2.9067)	–0.1749*** (–2.9407)
West Azerbaijan	2008S2	2	–0.4225** (–4.0816)	0.1580*** (2.6512)
Qazvin	1995S1	0	–0.6230*** (–4.3589)	0.0493 (0.8276)
Gilan	2001S2	0	–0.8703*** (–5.6879)	–0.1219* (–1.5260)

(Continued)

House prices	TB	K	S_{t-1}	B_t
(Continued)				
Fars	2009S1	0	–0.4968** (–3.7258)	0.1107 (1.2995)
East Azerbaijan	2008S2	0	–0.2680 (–2.5495)	0.1818*** (3.0622)
Yazd	2006S1	0	–0.2849 (–2.6413)	0.1453** (2.3264)
Zanjan	1999S2	0	–0.8429*** (–5.5311)	0.0358 (0.4533)
Land prices				
Khuzestan	2000S2	0	–0.9688*** (–6.2819)	0.4255** (2.3271)
Markazi	1998S1	0	–0.4661** (–3.5723)	0.0256 (0.1528)
Ardabil	2009S1	0	–0.7263*** (–4.8938)	0.3053** (1.9819)
Esfahan	2005S1	0	–0.6717*** (–4.6087)	0.2510* (1.5716)
Qom	2000S2	0	–0.9128*** (–5.9385)	–0.3240 (–0.8914)
Golestan	2007S2	0	–0.5712** (–4.0978)	–1.1616*** (–7.4148)
Hamedan	2007S2	0	–0.8249*** (–5.4298)	–0.5545*** (–3.0849)
Alborz	2001S1	0	–0.6639*** (–4.5682)	0.1753 (1.1705)
Kerman	1994S2	0	–0.3530 (–3.0005)	–0.1859 (–0.8707)
Kermanshah	2004S1	0	–0.9568*** (–6.2064)	0.0590 (0.3844)
Razavi Khorasan	2008S2	0	–0.4320* (–3.4018)	–0.2287* (–1.3869)
West Azerbaijan	2008S1	1	–0.5381 (–3.0136)	–0.0735 (–0.4089)
Qazvin	2005S2	0	–0.7387*** (–4.9596)	0.3723*** (2.4402)
Gilan	1999S1	1	–0.4479 (–2.8661)	0.2653 (0.9902)
Fars	2004S1	0	–0.8360*** (–5.4924)	–0.4012** (–2.1939)
East Azerbaijan	2004S1	0	–0.8721*** (–5.6984)	–0.2029* (–1.3252)
Yazd	2008S1	0	–0.5957*** (–4.2208)	0.1932 (1.1212)
Zanjan	2009S2	0	–0.9113*** (–5.9293)	0.2357* (1.3123)

Notes: TB is the date of the structural break; *K* is the lag length; S_{t-1} is the LM test statistic; B_t is the dummy variable for the structural break in the intercept. Figures in parentheses are t–values. Critical values for the LM test statistic from Lee and Strazicich (2004) at the 10%, 5% and 1% significance levels are –3.211, –3.566 and –4.239 respectively. Critical values for other coefficients follow the standard normal distribution. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Table B. Univariate LM unit root test with one break in the intercept and trend (Model C)

House prices	TB	k	S_{t-1}	B_t	D_t
Khuzestan	2001S1	2	–0.4821 (–3.6861)	0.1481** (2.2864)	0.0371* (1.3819)
Markazi	1998S1	0	–0.3407 (–2.9365)	0.0582 (0.8435)	0.0953*** (2.9661)
Ardabil	1997S1	0	–0.9055*** (–5.8946)	–0.0488 (–0.7243)	–0.0447* (–1.6207)
Esfahan	2006S1	1	–0.8690** (–4.8172)	–0.0462 (–0.8884)	–0.0420** (–1.9951)
Qom	2004S1	1	–0.7534*** (–5.1146)	0.1522** (1.7845)	–0.0900*** (–2.6607)
Golestan	2001S2	0	–0.2827 (–2.6292)	–0.1461** (–2.0534)	–0.0427** (–1.8898)
Hamedan	2002S1	0	–0.7216** (–4.8688)	0.0376 (0.2547)	0.0479 (1.0448)
Alborz	2004S1	2	–0.6721*** (–5.7557)	0.0086 (0.1951)	–0.0718*** (–3.5996)
Kerman	2006S2	2	–0.7439* (–4.2776)	–0.3827*** (–3.0415)	0.1888*** (2.7837)
Kermanshah	1995S2	0	–0.7807*** (–5.1859)	0.0371 (0.5374)	–0.0424 (–1.2538)
Razavi Khorasan	2005S1	0	–0.4812 (–3.6479)	–0.0095 (–0.1543)	–0.0819*** (–2.8187)
West Azerbaijan	2002S1	2	–0.3589* (–4.2054)	–0.1190** (–2.0027)	0.0358** (1.9267)
Qazvin	1995S2	2	–1.1207*** (–5.2490)	–0.0988* (–1.6604)	0.0962** (2.3605)
Gilan	2001S2	0	–1.0625*** (–6.8990)	–0.0820 (–1.1223)	–0.0656*** (–2.6396)
Fars	2007S2	0	–0.7679** (–5.1165)	0.0386 (0.4895)	0.0911*** (2.7764)
East Azerbaijan	2006S1	0	–0.5206 (–3.8445)	–0.1515*** (–2.5586)	0.0239 (1.2880)
Yazd	2007S1	0	–0.4103 (–3.2924)	–0.0032 (–0.0482)	0.0698*** (2.4628)
Zanjan	2001S1	0	–0.8944*** (–5.8289)	0.0121 (0.1556)	0.0385* (1.5063)
Land prices					
Khuzestan	1999S2	0	–1.0124*** (–6.5614)	0.2189 (1.2215)	0.0469 (0.7854)
Markazi	1999S1	0	–0.8605*** (–5.6320)	0.6103*** (5.1441)	0.0384 (0.9619)
Ardabil	2009S1	0	–0.7419** (–4.9764)	0.2966** (1.8604)	0.0457 (0.7952)
Esfahan	2006S1	0	–0.8657*** (–5.6616)	–0.1830 (–1.2995)	0.0034 (0.0755)
Qom	1999S2	0	–1.0415*** (–6.7554)	0.1134 (0.3301)	–0.3977*** (–3.0941)
Golestan	2006S2	0	–0.6651** (–4.5746)	–0.0183 (–0.0928)	–0.1890*** (–2.7695)
Hamedan	2007S1	0	–0.7358** (–4.9441)	–0.6449*** (–3.7575)	0.1436** (2.2161)
Alborz	2001S1	0	–0.6433* (–4.4624)	0.2047* (1.3447)	0.0191 (0.3995)
Kerman	1999S2	0	–0.7177** (–4.8484)	–0.1700 (–0.8920)	0.3378*** (3.8157)

(Continued)

House prices	TB	k	S_{t-1}	B_t	D_t
(Continued)					
Kermanshah	1996S2	0	–0.9080*** (–5.9099)	0.0589 (0.3807)	–0.0728 (–1.1333)
Razavi Khorasan	2009S1	0	–0.9837*** (–6.3759)	–0.1335 (–0.9701)	–0.3836*** (–5.2143)
West Azerbaijan	2005S2	0	–0.7564*** (–5.0544)	–0.5025*** (–2.8926)	0.1764*** (2.8624)
Qazvin	2005S2	0	–0.7785*** (–5.1737)	0.3253** (2.1258)	0.0175 (0.3662)
Gilan	2004S2	0	–0.9069*** (–5.9032)	1.5184*** (7.2132)	–0.3863*** (–4.7731)
Fars	2004S2	0	–0.8295*** (–5.4554)	–0.1815 (–0.9396)	–0.0414 (–0.6958)
East Azerbaijan	2002S2	0	–0.8904*** (–5.8057)	–0.2584** (–1.7881)	0.0605* (1.3400)
Yazd	2008S2	0	–0.7797*** (–5.1803)	0.1678 (1.0052)	0.1367** (2.0901)
Zanjan	2007S2	0	–1.0409*** (–6.7515)	–0.1658 (–0.9659)	0.2696*** (3.9463)
Critical values					
Location of break, λ	0.1	0.2	0.3	0.4	0.5
1% significant level	–5.11	–5.07	–5.15	–5.05	–5.11
5% significant level	–4.50	–4.47	–4.45	–4.50	–4.51
10% significant level	–4.21	–4.20	–4.18	–4.18	–4.17

Notes: TB is the date of the structural break; *k* is the lag length; S_{t1} is the LM test statistic; B_t is the dummy variable for the structural break in the intercept; D_t is the dummy variable for the structural break in the slope. Figures in parentheses are t–values. The critical values for the LM test statistic are symmetric around λ and (1–λ). Critical values for other coefficients follow the standard normal distribution. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.