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House Price Rigidity and the Asymmetric Response of Housing Prices to Monetary Policy in Iran

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This paper examines downward price rigidity in Iran's housing market and discusses whether this characteristic would result in an asymmetric relationship between housing prices and monetary policy. To test the downward house price rigidity, the threshold GARCH model is developed. The asymmetric adjustment to monetary policy is examined using the asymmetric cointegration and error correction models. Estimating the models using quarterly data from 1992Q2 to 2017Q1, the results indicate the presence of the downward house price rigidity in Iran's housing market. Moreover, house prices are asymmetrically adjusted to monetary policy such that house prices are increased in response to a loose monetary policy whereas displayed a large amount of persistency following a tight monetary policy. The results imply that house prices tend to overreact in upturns and underreact in downturns reaffirming the downward house price rigidity in Iran. Hence, the government should consider the asymmetric house price adjustment when implementing relevant policies for the housing market to avoid the creation of a bubble or the recession of the housing market.

Keywords: Downward House Price Rigidity, Monetary Policy, Threshold GARCH, Asymmetric Cointegration, Error Correction Model.
JEL Classification: C22, E52, R31

1 Introduction

A significant number of empirical studies have investigated the irrational behavior of traders in financial markets in recent years. This line of research belongs to the category of behavioral finance that provides explanations for why people make irrational financial decisions by combining behavioral and cognitive psychological theory with conventional economics and finance. Cognitive psychologists Kahneman and Tversky (1979) propose the "prospect theory" in behavioral finance. According to this theory "losses have more emotional impact than an equivalent amount of gains". In other words, people obtain less utility from gaining than losing. Prospect theory suggests that an individual's value function is concave in gains (as for a risk averse individual

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in expected utility theory), but convex in losses. In addition, it argues that the function is much more sensitive to losses relative to equivalent-size gains. Shefrin and Statman (1985) use this theory to suggest the “disposition effect” describing that investors hold assets that dropped in value while sell assets that have risen in value. In other words, investors are willing to gamble in the domain of losses and hold losing assets too long but are willing to sell well-performing assets too readily.

Some studies have tried to extend this irrational behavior to the housing market. For instance, Case and Shiller (1989) and Shiller (2005) suggest that the irrational behavior of house market participants causes house price inefficiency. Genesove and Mayer (2001) confirm the presence of the “disposition effect” in the real estate markets. Engelhardt (2003) support the findings of Genesove and Mayer (2001) that loss aversion is an important housing market phenomenon.

The loss aversion phenomenon in housing market has an important implication for the downward house price rigidity. Real estate investors have a tendency to sell their homes when prices have increased, but keeping their homes in times of reduction in prices to avoid loss. Dobrynskaya (2008) empirically observe the house price downward rigidity based on a behavioral model in which traders maximize their utility. The real estate sellers will not sell their homes during a decline in nominal house prices because they are willing to avoid capital losses. In other words, during the bad market conditions the reserve price of the seller is higher than the expected prices of the buyer, thereby lengthening the selling time and makes the housing prices less likely to drop sharply and rapidly. This phenomenon leads to downward house price rigidity. Tsai and Chen (2009) and Tsai (2013) also demonstrate the presence of house price downward rigidity in the U.K housing market. Their findings indicate that the volatilities between housing prices moving up and down are asymmetric, that is, when housing prices move down (when bad news occurs), the variance of housing prices decreases. In other words, in news incidents that caused housing prices to reduce, the extent of changes in prices will decrease and eventually lead to price rigidity.

Downward house price rigidity might influence its relationship with other variables (see for instance, Dufrenot and Malik (2012) for a relationship between housing prices and business cycles and Tsai et al., 2011 for a relationship between housing prices and stock prices). One important variable is monetary policy that is widely used by government officials to influence the housing prices[1]. Many empirical studies have investigated the impact of monetary policy on housing prices. For instance, Adalid and Detken (2007) explore the effect of broad money growth on housing prices in a panel of industrialized countries and find that the link is significant and particularly strong in times of aggregate asset price booms. Goodhart and Hofmann (2008) using a panel VAR for 17 industrialized countries discover the evidence of a significant link between housing prices and monetary variables. By employing the same methodology, Assenmacher-Wesche and Gerlach (2008) find significant response of housing prices to monetary policy shocks. Iacoviello and Neri (2009) with a DSGE Model in the US housing market found that housing prices are sensitive to monetary shocks. More specifically, they discover that a 50 basis point increase in the federal funds rate leads to an immediate 0.75 percent decrease in housing prices. Gupta et al. (2010) assess the impact of monetary policy on real house price growth in South Africa using a Factor-Augmented Vector Autoregression (FAVAR) model. The results, based on the impulse response functions, indicate that house price inflation responds negatively to monetary policy shock. Wadud et al. (2012) examine the role of monetary policy in the Australian housing market using structural VAR models and uncover that a contractionary monetary policy does not exert any significant negative impact on the real house prices. Rahal (2016) examine the response of housing markets to unconventional monetary policy shocks in the form of innovations in total assets and the monetary base for eight OECD countries. The results of the panel VAR models show a positive and persistent response of housing prices which peaks at one or two years following a policy shock.

The studies reviewed above have not investigated the possible asymmetry in the relationship between monetary policy and housing prices. Further, studies such as Chen et al. (2012) point out that money supply is the key threshold variable that influences the asymmetric behavior of housing prices. In the presence of downward price rigidity, the impact of monetary policy on

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[1] Mishkin (2007) and Boivin et al., (2010) provide three channels in which monetary policy affects housing price. The first channel is through the impact of interest rate on the user cost of capital. A contractionary monetary policy via increase in interest rate reduces housing demand by raising the user cost of capital. The fall in housing demand leads to a decline in housing price. The second channel is through the supply side in which increase in policy rate rises financing construction cost, causing a fall in housing supply and thereby housing price will increase. The third channel is credit channel through consumer spending. An increase in interest rates and subsequent increase in mortgage rates will reduce the cash flows of credit-constrained households, thus reducing housing demand and price.

housing prices might be asymmetric when price moving up and down. Beatrice et al., (2013) using Markov-Switching Vector Autoregressive (MS-VAR) models find that the impact of monetary policy on housing prices is larger in bear regime than in bull regime of housing market. Tsai (2013) discover an asymmetric relationship between housing prices and monetary policy. By employing money supply as the proxy variable of monetary policy and data from the UK housing market, the results of the traditional and threshold error correction models indicate that housing prices are asymmetrically adjusted to money supply. Housing prices are increased in response to a loose monetary policy. Conversely, housing prices cannot easily decrease in response to a tight monetary policy. These findings indicate that housing prices tend to overreact in upturns and underreact in downturns. Hence, as pointed out by Tsai (2013) the government should consider the asymmetry of house price changes at the time of policy implementation to avoid the creation of a bubble or the collapse of the housing market.

In the case of Iran housing market, Abolhasani et al (2017), by employing a Dynamic Stochastic General Equilibrium (DSGE) model over 1991-2011, study the impact of monetary shocks on prices and output of housing sector. Results of the impulse response functions show that higher money growth rate temporarily increases output and inflation in the housing sector. Shahbazi and Kalantari (2012), using structural VAR models and quarterly data spanning from 1991 to 2008, investigate the impact of monetary policy shocks on housing price in Iran. The findings of the impulse response functions indicate that money supply has a positive and significant impact on housing prices in the long-run. However, the impact of interest rate on housing prices is not significant. Gholizadeh and Kamyab (2010) analyses the response of monetary policy to bubble in housing price using an ARDL model with quarterly data for Iran. The results indicate that monetary authorities should consider house price bubbles in the monetary regulations to minimize the loss function of the Central Bank. Their findings also reveal that monetary policy has a considerable impact on the house price fluctuations and creation of bubbles in housing market. Heydari and Soori (2010) study the relation between bank deposit rates and housing prices in Iran using VAR models and find that there is a negative relation between bank deposit rates and housing prices.

Although the empirical studies of the Iran housing market indicate a positive link between expansionary monetary policies and housing prices, none of these studies investigate the downward house price rigidity in Iran housing market and its relationship with monetary policy. Therefore, we contribute to the existing literature in two directions. First, we test the downward house price rigidity in Iran housing market. After observing downward house price rigidity, the second contribution of this study is to examine the asymmetric impact of monetary policy on housing prices in Iran. Observing the downward house price rigidity and the resulting asymmetries to monetary policy is crucial to prevent a housing crisis and subsequent negative impact on the overall economy. The rest of the paper is structured as follows: the next section describes house prices trend in Iran. The methodology and the data are presented in section 3. Section 4 reports the empirical results. Finally, Section 4 provides a summary of the main findings and policy implications.

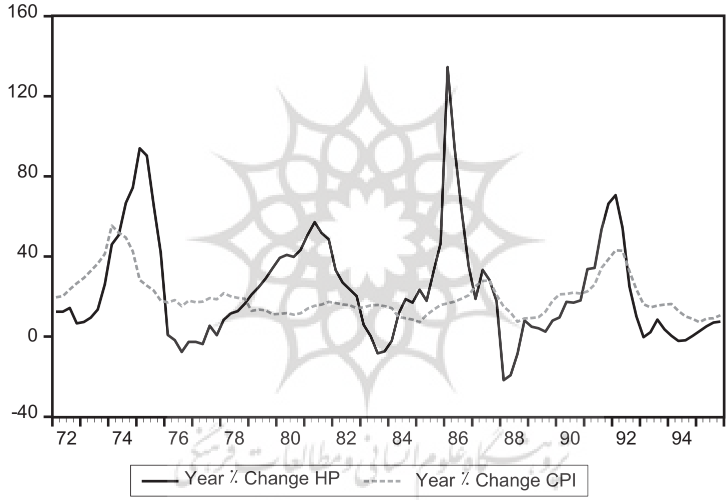

Figure 1. The annual growth of house prices and inflation. *Source:* Research Findings

2 House Prices Trend in Iran

The average annual growth of nominal house prices in Iran over the sample period considered in the study is 23.5%. This average growth rate is slightly higher than the average of inflation rate (19.6%) in the sample period. However as depicted in Figure 1 in the periods of hyperinflation the growth rate of housing prices is far above the inflation rate. Also, the growth rate of housing prices is lower than the inflation rate in some periods, however it is increased rapidly even higher than inflation rate in the following period. As demonstrated by Gholizadeh and Kamyab (2010) in the years of the recession, the house price index remains behind the index of other commodities and the general inflation, but it compensates for the following expansionary years in order to balance the value of properties in the household's portfolio.

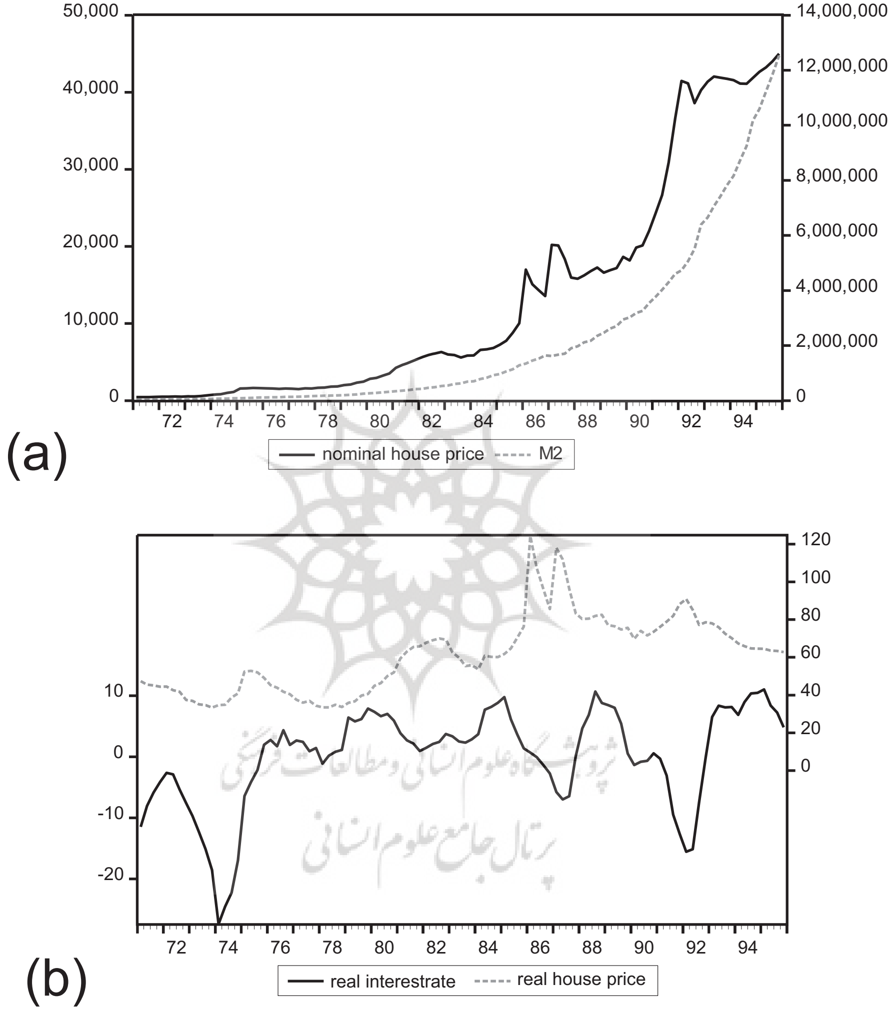

Figure 2. Time series of house price, M2 and real interest rate. Time series of nominal house price and nominal M2 are depicted in panel (a) while time series of real house prices and real interest rate are depicted in panel (b). *Source:* Research Findings

Time series of nominal and real house prices, and their relations with money supply and real interest rate are depicted in figure 2. As it is evident from panel (a) of figure 2, housing prices and M2 are increased in the same direction. However, it can be observed from panel (b) of figure 2 that real house prices are increased in the periods of decrease in real interest rate.

3 Methodology

The empirical approach of this study consists of three steps. In the first step following Tsai (2013) we develop the Threshold Generalized Autoregressive Conditional Heteroskedasticity (GJR-GARCH) model proposed by Glosten et al. (1993) to detect the downward house price rigidity in Iran housing market. This model is capable of capturing the asymmetric impact of positive and negative shocks upon return volatilities to identify downward house price rigidity in the housing market. In the second step, considering the downward price rigidity, it is inferred that the impact of monetary policy on housing prices may be asymmetric when housing prices moving downward or upward. In other words, the integration of the two variables is non-linear with a threshold effect. Thus, this study uses the asymmetric cointegration tests developed by Enders and Granger (1998) and Enders and Siklos (2001), referred to as the ES test, as an alternative to the conventional cointegration tests[1]. In the final step, providing that the variables of interest are asymmetrically cointegrated, the asymmetric error correction models are estimated to combine the short-run dynamics and long-run information in the data series.

3.1 Downward House Price Rigidity: GJR-GARCH Model

The $GJR-GARCH(p,q)$ model proposed by Glosten et al. (1993) consists of a mean equation and a volatility equation as follows:

$$R_t = \mu_0 + \varepsilon_t \quad (1)$$

$$\varepsilon_t / I_{t-1} \sim N(0, h_t^2) \quad (2)$$

$$h_t^2 = \omega_0 + \sum_{i=1}^{p} \beta_i h_{t-i}^2 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \gamma \varepsilon_{t-1}^2 D_{t-1} \quad (3)$$

Where q and p refer to order of ARCH and GARCH terms, respectively. R_t denotes the return of housing prices at time t computed as the logarithmic difference of housing prices. The model error term (ε_t), given the information set up to time $t-1$, is a random variable with a zero mean and conditional variance h_t^2. In the conditional variance equation specified in equation (3),

[1] The conventional cointegration tests include the residual-based test by Engle and Granger (1987) and the VAR-based test by Johansen (1988) and Johansen and Juselius (1990), respectively referred to as the EG and JJ tests.

D_{t-1} is a dummy variable. When $\varepsilon_{t-1} < 0, D_{t-1} = 1$; otherwise, $D_{t-1} = 0$. In this setting negative lagged error ($\varepsilon_{t-1} < 0$) corresponds to the bad news and positive lagged error ($\varepsilon_{t-1} > 0$) denotes good news. It is allowed that good news and bad news have asymmetric impacts on the conditional variance. Good news has an impact of α_i, while bad news has an impact of $\alpha_i + \gamma$. A significantly negative γ implies that a defensive effect exists because bad news is followed by a decreasing variance. Hence, housing prices are only sticky when moving downward.

3.2 Asymmetric Cointegration

The asymmetric cointegration test developed by Enders and Granger (1998) and Enders and Siklos (2001) is based on the following specification of the residuals:

$$\Delta u_t = \rho_1 I_t u_{t-1} + \rho_2 (1 - I_t) u_{t-1} + \sum_{i=1}^{k} \mu_i \Delta u_{t-i} + e_t \quad (4)$$

Where u_t is the error term obtained from the long-run relation between housing prices and monetary policy indicator. I_t is the Heaviside indicator function and k is the optimal lag order to make the disturbance term in Equation (4) serially uncorrelated. The Heaviside indicator function can be specified to depend on the level of the error terms, called the threshold autoregressive (TAR) model, such that I_t can be written as:

$$I_t = \begin{cases} 1 & if\ u_{t-1} \geq 0 \\ 0 & if\ u_{t-1} < 0 \end{cases} \quad (5)$$

As an alternative specification, I_t is called the momentum TAR (M-TAR) and specified to depend on the changes of the error terms such that:

$$I_t = \begin{cases} 1 & if\ \Delta u_{t-1} \geq 0 \\ 0 & if\ \Delta u_{t-1} < 0 \end{cases} \quad (6)$$

Based on both TAR and M-TAR models, the necessary condition for cointegration is that $-2 < (\rho_1, \rho_2) < 0$. The null hypothesis of no cointegration based on ES test ($H_0: \rho_1 = \rho_2 = 0$) can be tested using the F-statistics. Since the F-statistics has a non-standard distribution, we need to refer to the critical values as tabulated in Enders and Siklos (2001). In the presence of cointegration, the null hypothesis of asymmetric cointegration ($H_0: \rho_1 = \rho_2$) can be tested using the standard F-statistics. Rejecting the null provides evidences for the presence of the asymmetric adjustment process toward the long-run.

3.3 Asymmetric Error Correction Models

To estimate the asymmetric error correction models the following specification is estimated:

$$\Delta LHP_t = \mu + \lambda_1 Z_t^+ + \lambda_2 Z_t^- + \sum_{i=1}^{k_1} \delta_i \Delta LHP_{t-i} + \sum_{i=0}^{k_2} \theta_i \Delta MP_{t-i} + e_t \qquad (7)$$

where Δ is the first difference operator, $Z_t^+ = I_t u_{t-1}$, $Z_t^- = (1 - I_t) u_{t-1}$, LHP stands for logarithm of housing prices, MP is monetary policy indicator including logarithm of M2 money aggregates or real interest rate. λ_1 and λ_2 coefficients are error correction terms and measure the speed of adjustment to the long-run equilibrium path. The finding $\lambda_1 \neq \lambda_2$ indicates that the adjustment speeds to the long-run path is asymmetric. $|\lambda_1| > |\lambda_2|$ reflects faster convergence to the long run equilibrium for positive than negative discrepancies.

4 Empirical Results

4.1 Data and Preliminary Analysis

Quarterly data from the Iran housing market spanning from 1992Q2 to 2017Q1 are used in this study. The housing price data is the average price of 1 square meter apartment (1000 IRR) and is obtained from the Ministry of Road and Urban Development of the Islamic Republic of Iran through its official website (http://www.mrud.ir). To measure monetary policy, the M2 money aggregates is employed. We also use real interest rate as an alternative monetary policy indicator. The interest rate used is the long term deposit rate (1 year). Real interest rate is computed by subtracting inflation rate from nominal interest rate. Inflation rate is calculated by taking logarithmic difference of consumer price index (2005=100). M2 money aggregates, nominal interest rate and consumer price index (CPI) are retrieved from the Central Bank of Iran through its official website (http://www.cbi.ir). All data series except real interest rate are expressed as natural logarithms. Descriptive statistics for the data are listed in Table 1. For all the variables mentioned above, unit root tests is conducted to investigate whether these series are stationary. The results of the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test are reported in Table 3. Clearly, the hypothesis of unit root process is not rejected for both series in level while this hypothesis is rejected in first difference. Thus, the variables are integrated of order 1 or I(1).

Table 1
Descriptive Statistics

	HP (in 1000 Rial)	M2 (in billion Rial)	Real interest rate (%)
Mean	13212.17	2137051.00	0.11
Median	5950.50	614101.60	1.838
Maximum	44996.00	12533900.00	11.05
Minimum	451.00	29158.70	-27.42
Std. Dev.	14672.28	3070423.00	8.07
Skewness	1.06	1.80	-1.23
Kurtosis	2.68	5.36	4.37

Notes: HP is house price and M2 is M2 money aggregates. *Source:* Research Findings

4.2 Downward House Price Rigidity: Results of GJR-GARCH Model

The results of the GJR-GARCH model described in section 2.1 are presented in Table 2. As depicted in Table 1, the estimated asymmetrical volatility indicator (γ) is significantly negative for the Iran housing market at -0.556 indicating that the occurrence of bad news reduces volatility of returns. This means that the extent of changes in price will decrease and eventually lead to downward house price rigidity. The result is consistent with that of Tsai and Chen (2009) and Tsai (2013).

Table 2
Empirical Results of the GJR-GARCH (1, 1) Model.

	Coefficient	Std. error
Mean equation		
$\boldsymbol{\mu_0}$	0.042^{***}	0.008
Variance equation		
$\boldsymbol{\omega_0}$	0.001^{***}	0.000
$\boldsymbol{\beta_1}$	0.649^{***}	0.065
$\boldsymbol{\alpha_1}$	-0.556^{***}	0.075
$\boldsymbol{\gamma}$	0.293^{***}	0.076

Notes: *** denotes significance at 1% level. *Source:* Research Findings

4.3 Asymmetric Cointegration Tests

The results of the ADF and PP unit root tests, presented in Table 3, clearly indicate that all data series under consideration are integrated of order 1, or I(1). Accordingly, we proceed to ES cointegration tests based on both TAR and M-TAR models. For comparison, the EG and JJ cointegration tests are also conducted. The EG and JJ cointegration test results are reported in Table 4, while Table 5 reports the ES cointegration test results. From the results, the null of no cointegration can be rejected by all cointegration tests at least in 10% significance level. However, as reported in Table 5, in the case of employing M2 as monetary policy indicator the null of symmetric adjustments is rejected by standard F-statistics using TAR models. In the case of using real interest rate to measure monetary policy, the null of symmetric adjustment cannot be rejected using the TAR and M-TAR models.

Table 3

ADF and PP Unit Root Tests

Variables	Level		First difference	
	ADF	PP	ADF	PP
LHP	-3.879*	-1.767	-4.483***	-8.795***
LM2	-3.416*	-3.372*	-4.263***	-15.017***
r	-2.588*	-2.317	-7.092***	-4.877***

Notes: LHP= logarithm of house prices; LM2= logarithm of M2 money aggregates. r = real interest rate. For the LHP an LM2 variables the ADF and PP test equations include both the constant and trend term for the level equations and the constant term for the first difference equations. For variable r the ADF and PP test equations include the constant term for the level and first difference equations. The Schwarz information criterion (SIC) is used to select the optimal lag order in the ADF test equation. *** and * denote significance at 1% and 10% level; respectively. *Source:* Research Findings

Table 4

EG And JJ Cointegration Tests.

Variables	EG test	JJ test	Null hypothesis	
			$r = 0$	$r \leq 1$
LHP, LM2	-3.662*	Trace	14.940*	0.069
		Max	14.871**	0.069
LHP, r	-3.542***	Trace	49.904***	13.166
		Max	36.738***	13.166

Notes: The EG test statistic is tau-statistic and the probability values are derived from the MacKinnon response surface simulation results. The EG test statistic is computed using C and @TREND as deterministic regressors, and the optimal lag order in the ADF regression is determined using automatic lag selection with a Schwarz criterion. For the EG test the Null hypothesis is that series are not cointegrated. The VAR lag order for the JJ test is based on non-autocorrelated errors. ***, ** and * denote rejection of the null hypothesis at the1%, 5% and 10% level, respectively. *Source:* Research Findings

Table 5
Asymmetric Cointegration Test.

Variable	TAR		M-TAR	
	F-stat $H_0: \rho_1 = \rho_2 = 0$	F-stat $H_0: \rho_1 = \rho_2$	F-stat $H_0: \rho_1 = \rho_2 = 0$	F-stat $H_0: \rho_1 = \rho_2$
LHP, LM2	9.060	2.953 (0.089)	7.436918	0.166 (0.684)
LHP, r	15.414	8.865 (0.004)	14.671	17.21 (0.063)
Critical values				
5%	6.28		6.20	
10%	5.20		5.20	

Note: The numbers in brackets are *p*-values. The optimal lag order of the test equation is based on the non-autocorrelated error terms. *Source:* Research Findings

4.4 Asymmetric Error-Correction Modeling

As reported in Table 5, in the case of employing M2 as monetary policy indicator, we find the evidences of asymmetric adjustment process embedded in TAR models. So, the asymmetric error-correction modeling based on the TAR-consistent model is estimated. In arriving at the final specifications, the general-to-specific procedure is applied to trim insignificant first-differenced right-hand side variables. The estimation results of asymmetric error-correction models and diagnostic tests are presented in Table 6. To correct the coefficients' standard errors, the model is estimated with the Newey–West Heteroskedasticity and Autocorrelation consistent covariance (HAC) estimator. As reported in the Table 6, the error terms are not autocorrelated and heteroskedastic up to order 3.

The estimation results of asymmetric error-correction models indicate that an expansionary monetary policy exerts significant and positive short-run influences on housing prices as suggested by the coefficient of lagged differenced M2. Apart from the short-run relation between monetary policy and housing prices, the estimated results also document significant error-correction coefficient when the housing prices are above their long-run values. Hence, the estimates suggest that positive discrepancies from the long-term equilibrium between monetary policy and housing prices (Z_t^+) are eliminated relatively quickly, whereas negative discrepancies from this long-term equilibrium (Z_t^-) are persistent. In other words, when housing prices are above their equilibrium levels following a loose monetary policy, they converge to their long-term equilibrium level relatively quickly so that 35.6% of discrepancies eliminate in each period. On the other hand, the decreases in housing prices following a tight monetary policy displays a large amount of persistency. This result implies that when the housing prices have a comparatively greater room for downward movement the correcting behavior is not significant. These findings confirm downward price rigidity in housing prices. In this situation, a loose or tight monetary policy causes the asymmetric influence on housing prices. The decrease of housing prices following a contractionary monetary policy is significant while the increase of housing prices in response to an expansionary monetary policy is not significant.

Table 6
Asymmetric Error-Correction Models (M2 as Monetary Policy Indicator)

Variable	Coefficient	Std. error
$\boldsymbol{Z_t^+}$	-0.356***	0.102
$\boldsymbol{Z_t^-}$	0.131	0.097
$\boldsymbol{\Delta LHP_{t-1}}$	0.236***	0.084
$\boldsymbol{\Delta LHP_{t-2}}$	0.243*	0.145
$\boldsymbol{\Delta LM2_{t-1}}$	0.857**	0.358
$\boldsymbol{\Delta LM2_{t-2}}$	0.282*	0.208
	LM(3)= 1.641 (0.186)	ARCH(3)= 0.228 (0.876)

Note: ***,** and * denote significant at 1% , 5% and 10% respectively. LM(3) is LM test for serial correlation up to order 3; ARCH(3) is autoregressive conditional heteroskedasticity test up to order 3. *Source:* Research Findings

The results of the asymmetric error correction models based on TAR and M-TAR models in the case of employing real interest rate as monetary policy variable are reported in Table 6. The estimated results indicate significant error-correction coefficient when the housing prices are below their long-run values. Hence, the estimates suggest that only negative discrepancies from the long-term equilibrium between real interest rate and real housing prices (Z_t^-) are eliminated quickly, whereas positive discrepancies from this long-term equilibrium ($Z_t^{\mp}$) are persistent.

These findings can be explained by the negative relation between real house prices and real interest rate. This result implies that when the housing prices have a comparatively greater room for downward movement the correcting behavior is not significant. These findings confirm downward price rigidity in housing prices. In this situation, a loose or tight monetary policy causes the asymmetric influence on housing prices. These findings suggest the asymmetric impact of monetary policy on housing prices. Accordingly, the increases in housing prices in response to an expansionary monetary policy (decrease in real interest rate) is significant while the decreases in housing prices following a tight monetary policy (increase in real interest rate) is not significant.

Table 6
Asymmetric Error-Correction Models (Real Interest Rate as Monetary Policy Indicator)

Variable	TAR model	M-TAR model
Z_t^+	-0.127	0.112
	(0.318)	(0.351)
Z_t^-	-0.813***	-0.841***
	(0.233)	(0.190)
ΔLHP_{t-1}	-0.103	-0.181*
	(0.126)	(0.180)
ΔLHP_{t-2}	-0.077***	-0.109
	(0.157)	(0.146)
ΔLHP_{t-3}	-0.401**	-0.454***
	(0.173)	(0.160)
Δr_{t-1}	0.003	0.003
	(0.003)	(0.002)
	LM(3)= 1.179 (0.323)	LM(3)= 4.977 (0.003)
	ARCH(3)= 0.670 (0.573)	ARCH(3)= 0.487 (0.745)

Note: ***, ** and * denote significant at 1%, 5% and 10% respectively. LM(3) is LM test for serial correlation up to order 3; ARCH(3) is autoregressive conditional heteroskedasticity test up to order 3. *Source:* Research Findings

5 Conclusion

Some studies have demonstrated that loss aversion is an important housing market phenomenon. According to this phenomenon real estate investors have a tendency to sell their homes when prices have increased, but keeping their homes in times of reduction in prices to avoid loss. Hence, housing prices tend to overreact in upturns and underreact in downturns. The loss aversion phenomenon in housing market has an important implication for the downward house price rigidity. The Downward house price rigidity might influence its relationship with other variables. One important variable that is widely used by government officials to influence the housing market is monetary policy. In the presence of downward price rigidity, the impact of monetary policy on housing prices might be asymmetric when price moving up and down. Thus, the government should consider the asymmetry of housing price changes at the time of policy implementation to avoid the creation of a bubble or the collapse of the housing market. Therefore, the goal of this paper is to test the downward house price rigidity in Iran housing market. Moreover, we examine the asymmetric impact of monetary policy on housing prices.

To test the downward house price rigidity in Iran housing market we develop the threshold GARCH model proposed by Glosten et al. (1993). This model is capable of capturing the asymmetric impact of positive and negative shocks upon return volatilities. If negative shocks (bad news) follows by a decreasing variance, housing prices will be sticky when moving downward. To examine the asymmetric impact of a loose or tight monetary policy on housing prices we use the asymmetric cointegration tests developed by Enders and Siklos (2001). Providing that the variables of interest are asymmetrically cointegrated, the asymmetric error correction models are estimated to capture the asymmetric adjustment toward the long run equilibrium.

The empirical results of this paper consistent with the findings of Tsai and Chen (2009) and Tsai (2013) indicate that the housing prices in Iran exhibit a more stable reaction to bad news. When bad news delivered in the earlier period, the conditional variance of price returns in the current period decreases. This downward house price rigidity may result in asymmetric relationships between housing prices and monetary policy. The results of the ES cointegration test indicate that housing prices and monetary policy are asymmetrically cointegrated. Having found the asymmetric adjustment toward the long run equilibrium, the estimation results of the asymmetric error-correction models indicate that positive discrepancies (following a loose monetary policy) from the long-term equilibrium are eliminated relatively quickly, whereas negative discrepancies (following a tight monetary policy) are persistent. These results verify the asymmetric impact of monetary policy on housing prices in Iran. Housing prices are increased to reflect a loose monetary policy whereas they are persistent following a tight monetary policy. Therefore, monetary authorities, when implementing monetary policy to affect the housing market, should consider the asymmetry of housing price changes. Otherwise, their policies may result in the creation of a house price bubble or in the recession of the housing market.

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