THE INFLUENCE OF MONETARY POLICY ON HOUSING MARKET: EVIDENCES FROM TURKEY

Seyfettin ERDOĞAN*Çağrı YILDIRIM**Ayfer GEDİKLİ***Seda YILDIRIM****

* Prof. Dr., İstanbul Medeniyet University, Faculty of Political Sciences, Department of Economics  
** Assoc. Prof. Dr., Namık Kemal University, Faculty of Economics and Administrative Sciences, Department of Economics  
*** Assoc. Prof. Dr., İstanbul Medeniyet University, Faculty of Political Sciences, Department of Economics  
**** Assoc. Prof. Dr., Namık Kemal University, Faculty of Economics and Administrative Sciences, Department of Management

E-mail: seyfettin.erdogan@medeniyet.edu.tr, dcyildirim@nk.edu.tr, ayfer.gedikli@medeniyet.edu.tr, sedayildirim@nk.edu.tr

Copyright © 2019 Seyfettin ERDOĞAN, Çağrı YILDIRIM, Ayfer GEDİKLİ, Seda YILDIRIM. This is an open access article distributed under the Eurasian Academy of Sciences License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Purpose: Nowadays, the changes in the level of economic activities in the housing market are accepted as the most important signal of macroeconomic performance. This situation brings about the need to give importance to the investigation of policy implementations that affect economic activity in the housing market. So, this study aims to find out the effects of changes in the monetary policy on housing prices in Turkey as a sample of developing country.

Design/methodology/approach: This study employed Augmented Vector Autoregression (VAR) analysis. For housing prices; the Housing Unit price series, calculated by the Central Bank, spanning 2010M1-2016M3 are used. Housing unit price is calculated by Housing price per square meter. To represent production volume, the index of total industrial production has been used. To represent inflation series, CPU (Consumer Price Index) series have been used. The data has been taken from CBRT (the Central Bank of the Republic of Turkey) and TUIK (Turkish Statistical Institute).

Findings: Results show that policy interest rates are important indicators for the related term’s housing prices and it can also be said that the housing price channel has partially been effective. Accordingly, results determined that monetary policy had a significant effect on housing prices in Turkish housing market.

Originality/value: This study supports the argument that monetary policy has a significant effect on housing prices in developing countries like Turkey.

Key words: Housing market, Turkey, Monetary policy, Housing price channel, VAR analysis
1. Introduction

Asset price fluctuations have been an important subject in academic and political circles, particularly in the housing markets. The term “housing market” refers to four interrelated submarkets: new constructed single-family house, not sold yet or occupied, new rental houses, previously occupied houses which are offered for resale, previously occupied houses which are offered for rent (Naylor, 2017). With all these submarkets, housing market has different features from other assets. Although real estate is an asset, it is also a durable consumption good for households since it can provide shelter and other housing services. Because of these features, housing occupies one of the most important shares in household wealth. Since it is immobile, it is widely used as collateral for loans (Goodhart and Hofmann, 2007:5-8). And also, house prices are considered as the key channel of monetary policy transmission in some countries.

Actually, house prices are correlated with business-cycle movements in a wide range of real variables, like investment and consumption. Related to these attributes of housing prices, in many countries, construction sector has become one of the key sectors in the economies. In the last decade, especially in most of the industrial countries, house prices have increased dramatically due to low long-term real interest rates, economic growth and ample liquidity. So, house prices have risen with respect to income and rents which may lead speculation in housing market (Ahearne et al., 2005:1). On the other hand, there has been a debate if macroeconomic policy shocks contribute to worsen the volatility in house and other asset prices. Particularly in the eve of the Global Crisis period, many countries experienced strong rates of credit growth and increasing house prices. Nevertheless, the Global Crisis witnessed the devastating effects of uncontrolled subprime credits, housing boom and crash. Despite these problems, real estate finance and construction sector have continued to grow which brought the risk of financial instability (Williams, 2016:7). This process brought some critical questions which point the importance of monetary and regulatory policies. And also, if there is a coincidence between house prices and monetary variables, do fluctuations in house prices and monetary policy changes have effects on the development of real GDP and consumer prices? It is a fact that there is a multilateral inter-relation between monetary policy, house prices and the macroeconomic performance. House prices, monetary policy instruments, and other macroeconomic factors react interrelated to any shocks hitting the economy, and so, causality between these variables are difficult to distinguish. Traditionally, there is a two-way link between house prices and monetary policy. If the policy makers implement an expansive monetary policy, the stock and the marginal utility of liquid assets will change relative to the stock and the marginal utility of other assets. Policy makers will try to restore the equilibrium by adjusting spending and the asset portfolio in order to re-equate for all assets and the ratio of marginal utilities to relative price for consumption. This shows that an increase in money supply will result in rise in a broad range of asset prices and decline in interest rates and yields.

Similarly, a change in house price will affect the value of the stock of housing assets, motivating a portfolio to bring a re-equilibrium position which will indicate a new adjustment in the demand of monetary assets (Goodhart and Hofmann, 2008:6). Furthermore, as housing price information is generally very limited and open to the speculation, residential property markets are mostly not transparent enough. Lack of transparency may bring stronger macroeconomic shocks than other assets do. Besides, because of rising adverse selection and moral hazards, there are informational asymmetries in credit markets. This situation directly affects the borrowing capacity and borrowing costs which may result in persistent deviation of house prices (Goodhart and Hofmann, 2007:5-8).
Bernanke and Blinder (1988:439) explained that money demand shocks are more effective than credit demand shocks. However, this does not mean that we can ignore either one of them. Instead, it is more reasonable to work on treatments of money and credit. Also, if there are asymmetric information and imperfect contract enforcement which can be considered as credit market imperfection may result problems of opportunity cost of internal funds and increasing cost of external funds. Monetary policy of the local economy is critical at this point. Tight monetary policy increases both interest rates and the external finance premium which result in decrease in investment and consumption. Besides, tight monetary policy negatively affects borrowers’ net worth resulting in reduction in their cash flows because of increase in their debt burden or there may be devaluation of their pledgeable assets. This process may lead to apply external financial instruments (Iacoviallo and Minetti, 2008:70). On the other hand, the monetary policy shock that causes a decline in housing prices will lead to an increase in total demand. Changes in housing prices affect consumption expenditures through the credit channel.

The monetary policy shock that leads to a decrease or increase in housing prices affect the collateral levels of houses. For example, the monetary policy shock that leads to a decrease in housing prices results in the restrictions on credit facilities of homeowners. Constrained credit reduces consumption expenditures of household (Elbourne, 2008:67). So, any fluctuations in asset/housing prices not only affect the economic activities, but also affect credit facilities, the returns and discount rates. Thus, most of the financial sector instruments and assets are tied to housing values and any fluctuation may have dramatic effects on macroeconomic activities.

In the monetary policy transmission mechanism literature, the impact of changes in the monetary policy decision on the housing prices is defined as housing price channel of monetary policy. According to the literature, there are three channels of asset prices directly affect the economic activity (Gilchrist and Leahy, 2002:81):

- **The wealth effect:** Based on housing wealth and collateral effects on credit supply and demand, there is a link between credit and house prices. According to the lifecycle approach, a steady increase in housing wealth may encourage household spending and increase borrowing (Goodhart and Hofmann, 2008:7). While everything else is equal, wealthier groups consume more.

- **Tobin’s Q effect:** The direct effect of house price fluctuations on economy is basically due to residential investment. If there is an increase in house prices, there will be an increase of housing value with respect to construction costs. This value increase is evaluated by Tobin Q. According to Tobin, the ratio of the stock price to the replacement cost of capital which is called as a Tobin Q, is a referable statistic to analyze a firm’s invest incentives. If Tobin Q is greater than 1, capital is more valuable and investment is profitable. If house prices continue to increase, new housing construction becomes more profitable. Construction costs consist of building costs and the cost of land the building is constructed on. These two costs can be observable whereas Tobin Q is not observable (Goodhart and Hofmann, 2007:13).

- **The financial accelerator:** House prices may trigger consumption and investment by wealth effects and Tobin Q. House prices also affect bank lending through credit demand. Besides, through their effects on credit supply, they are also effective on balance sheets of banks. This effect may directly increase the banks own property. And also, bank capital can be used as collateral for loanable funds providers, like depositors. The availability of loanable funds to banks depends on the capitalization of these funds. Because of the effect of loanable funds on the value of banks’ housing wealth and loans secured by housing collateral, fluctuations in house prices may influence the capitalization of the banking system, credit supply. Hence, house prices affect both credit supply and credit demand. Furthermore, with its liquidity effect,
bank lending may affect property prices. This two-way nexus between house pricing and bank lending may improve bilateral cycles in credit and real estate markets. For example, a rise expectation in house price may stimulate the borrowing capacity of firms and households because of the increase in the value of collateral (Goodhart and Hofmann, 2007:15).

The process of the housing price channel can be explained as follows: An increase in housing prices leads to an increase in Tobin Q on this market and encourage the production of housing.

On the other hand, changes in housing prices affect consumption expenditures. Since housing is an important component of total wealth, an increase in housing price means an increase in wealth. As a result of increasing wealth, consumption expenditure will increase. At this point, the reasons those affect housing prices are crucial. Changes in housing prices are mostly affected by changes in monetary policy decisions. For example, when expansionary monetary policy is implemented, increase in housing prices is an expected outcome. Thus, the investment expenditures in the housing sector and expenditures of homeowners increase. This result means that total demand will increase (Mishkin, 1996:8). Another important indicator of changes in monetary policy decisions is the overnight interest rates in the interbank market. Changes in overnight interest rates can be effective not only on investment decisions but also on the consumption decisions of homeowners. Besides, interest rates are also effective on housing sector. The higher the interest rates, the higher the cost of purchasing a house that implies a lower asset value (Williams, 2016:7).

So, it can be said that investigating the effects of monetary policies on housing market is an important issue that we will determine the results of changes in housing prices based on monetary policies in Turkey to find empirical evidences as a sample of an emerging economy in the world.

2. Turkey’s Housing Market

The world economy can’t be thought without emerging markets that last decades has proved the importance of emerging markets for world economic growth (Hale, 2012:43). One of the biggest estimation for the future can be thought that emerging economies such as China, India, Brazil, Russia, Indonesia, Mexico and Turkey will have great economic growth by 2050. If countries of E7 get economic and political stability, they can have larger market than developed countries such as UK, France or Italy (PwC, 2015). International Monetary Fund (IMF) (2012) noted Turkey as an European Emerging Economy and Bloomberg (2013) classified the top 20 emerging economies in the world including Turkey as a number of 7. So, investigating emerging markets of Turkey has a significant value both for academicians and practitioners.

The vitality in the housing market is considered as the most important indicator of macroeconomic performance in many countries such as Turkey. Numerically, Turkish real market economy offers a great investment potential with its value of 19.5% of the total GDP (Investment Support and Promotion Agency of Turkey, 2013:5). The real estate market also represents 5% of GDP in the last ten years. In 2015, the real estate and construction sector occupied 4.1 billion USD and 24.8% of total FDI. According to Knight Frank House Price Index, Turkey was recorded as the 55th in terms of annual price growth index. Urban renewal projects are also started in different cities of Turkey. It seems approximately 6.7 million residential units are expected to be demolished and rebuilt over the next two decades. With all these attempts, JLL’s Cross Border Retailer Attractiveness Index showed Istanbul as 7th most attractive housing market in Europe after London, Paris, Moscow, Milan and Rome. Besides, Turkey can be considered as a top-performing housing market in the world with is 18.4% price increase ahead of New Zealand, Australia and Sweden (Investment Support and Promotion
Agency of Turkey, 2015). And also, Turkey was listed as “most improved” on the Global Real Estate Transparency index with its 3.6 investment performance in 2012 (Investment Support and Promotion Agency of Turkey, 2013:19). With all these improvements, positive developments in the housing supply and housing demand have become prominent. This situation increases the importance of researches on the variables affecting the housing market.

There are many variables that affect the volume of economic activity in the housing market. Factors that directly affect the sector are political stability, inflation, international economic and political conjuncture, exchange rates, investment opportunities in other sectors and profit expectations, changes in domestic and foreign demand, tax/incentive policies for the sector and changes in the monetary policy decisions. The results, obtained from the examination of these factors can be considered as a data source in the process of policy formulation for the sector. Related to these variables, this study aims to investigate the impact of changes in monetary policy decision on housing sector. Therefore a deep analysis of impact of monetary policy on housing market is crucial to forecast the impact of monetary policy on the whole economy.

3. Literature Survey
Recent studies have shown that monetary policy had a significant effect on housing prices both in developed and emerging economies. Jarocinski and Smets (2008) have tested the data from the US for the period from 1987:Q1-to 2007:Q2. According to the findings, monetary policy has significant effects on housing investment and housing prices. Expansionary monetary policy supports the boom in the housing market in 2004 and 2005. In a similar study, Xu and Chen (2012) investigated the effect of monetary policy on real estate price growth in China by using quarterly data from 1998:Q1 to 2009:Q4 and monthly data for July 2005-February 2010. The authors concluded that expansionary monetary policy had an accelerative effect on house price growth whereas tight monetary policy tends to have a decreasing effect on house price growth. Lastrapes (2002) also made an investigation on the dynamic response of aggregate owner-occupied housing prices to money supply shocks by using a vector autoregression (VAR). The author used monthly data and found that money shocks have significant effect on both real housing prices and housing sales. According to the author, if there is a positive shock to monetary supply, there is a rise on housing market in the short term. Also, Costello, Fraser and MacDonald (2015) investigated the influence of monetary policy shocks on housing prices in Australia through the methodology of Lastrapes (2002). They determined that monetary policy can affect housing prices significantly. Ahearne et. al. (2005) investigated the fluctuations of house prices and related monetary policy for 18 industrial countries since 1970. The authors found that housing prices are pro-cyclical and moving parallel with real GDP, output gaps, consumption, CPI inflation, investment, budget and current account balances. The authors figured out that after an expansionary monetary policy there is a boom on housing prices. However, this process finishes with a rising inflation. Policy makers launch restrictive monetary policy in order to control rising inflation. Pedram, Shirinbakhsh, and Afshar (2011), using data spanning from 1990:Q1 to 2009:Q2, have investigated the impact of monetary policy shocks on consumption and residential investments in Iran. The results revealed that housing price movements increased consumption about 38% and residential investment about 67% after a positive monetary policy shock. Wadud, Bashar, and Ahmed (2012), using quarterly data covering the period from 1974:Q2 to 2008:Q4, have examined the role of monetary policy in the Australian housing market. Their results expressed that a contractionary monetary policy reduced the housing activity significantly. It is a fact that, the improvement in housing market in an economy may have a significant effect on household wealth. So the attitudes of households are influenced of macro policy changes. Similarly, credit constraints caused by tightening
monetary policy reduces housing demand and then reduces housing prices (Wadud, Bashar, and Ahmed 2012: 852). Fratantoni and Schuh (2003) used heterogeneous-agent VAR (HAVAR) which integrated the financial market and national monetary authority with housing market from different regions. The authors investigated the impact of monetary policy on different regions for 1966-1998 in the US. By using HAVAR model, they could compare the reactions of different regions. So, they concluded that housing investment to monetary policy may be different from one region to another. A similar study was done for the case of Spain where housing prices dramatically increased after joining EMU by Aspachs-Bracons and Rabanal (2011). The researchers used VAR model for the period 1996-20007 and showed that when the central bank reacts to house prices, the housing sector is affected very heavily. They also figured out that if Spain had remained outside EMU, the housing sector could have boom and burst cycle. Guler (2012), using quarterly data set spanning 1991:Q1-2011:Q1, has examined the impact of housing wealth on aggregate consumer spending in Turkey. Findings show that housing prices have a significant effect on consumption and residential investment. After a contractionary interest rate shock, a decrease in housing prices has long-term effects accounting for 33% of the fall in consumption and 75% of the fall in residential investment. In their study, Adam and Woodford (2013) studied the relationship between housing prices and robustly optimal monetary policy. The authors found that shocks to housing demand and housing productivity may have “cost-push” effect which conveys temporary fluctuations in the inflation rate under optimal monetary policy. Contrary, under rational expectations, optimal policy can result in inflation and the output gap only. If policy is to be robust house prices and inflation, the target criterion is dependent on housing prices. In the empirical case, where the government subsidizes housing, the central bank should care the unexpected increase in housing prices. Ørobstad (2014) has investigated the effects of monetary policy shocks on housing prices during the period of 1994:Q1 – 2013:Q4 in Norway. He concluded that the effect of monetary policy on housing prices is strong. Calza, Monacelli, and Stracca (2013) have revealed that the impact of monetary policy shocks on residential investment and housing prices is significantly stronger in those countries which have more developed mortgage market. Williams (2015) has analyzed the economy of 17 countries in the past 140 years. Based on his study, it can be said that monetary policy has a significant impact on real housing prices and output in developed countries. Namely, an increase in interest rates leads to a decrease in real housing prices and hence real gross domestic products and inflation. A typical estimate is that a 1% loss in GDP is associated with a 4% reduction in the housing prices. Vargas-Silva (2008), using monthly data for the period from 1965:Q1 to 2005:Q12, has investigated the impact of monetary policy shock on the US housing market. The result shows that contractionary monetary policy shocks have a negative impact on housing starts and residential investment. McDonald and Stokes (2013), using the monthly data set for the period from 2000:1 to 2010:8, have examined the relationships among the federal funds rate, the housing prices etc. for the US. According to their findings, the federal funds rate was a cause of the housing price index changes both in rise and fall. Negative shocks to the federal funds rate increased housing prices. In an earlier study, Wheeler and Chowdhury (1993) searched the relationship between macropconomic activity and residential expenses for the period 1959:1 to 1991:1 by using variance decompositions and historical decompositions. The authors concluded that shocks to money stock, interest rates and output have remarkable impacts on residential expenditures. Parallel to these explanations, Bernanke explained that slower growth in home equity might lead households to increase their savings and control their spending (Federal Reserve Board, 2006). Bjørnland and Jacobsen (2010), using quarterly data from 1983:Q1 to 2006:Q4, have examined the role of housing prices in the monetary transmission mechanism in Norway, Sweden and the UK. The monetary policy shock that was performed with 1% increase in interest rates led to a fall in housing prices
by 3–5%. The fall in housing prices enhanced the negative response in output and consumer price inflation. Giuliodori (2005) also has tested data of nine European countries spanning the period from 1979:Q3 to 1998:Q4. According to the findings of the study, the interest rate shocks have strong effects on housing prices. Housing prices increase the impact of interest rate shocks on consumption expenditures positively. Yıldırım and Erdoğan (2014) have investigated on monthly data for the period of 2010:M01- 2013:M06 in order to test whether the housing price channel of monetary policy is valid or not. In the study, the effects of the changes in the overnight interest rate on output and inflation by influencing housing prices have been investigated. According to the findings, the housing price channel is not available, in other words, housing prices do not react to changes in the overnight interest rate. Kannan, Rabanal, and Scott (2009) emphasized that strong monetary reactions to accelerator mechanism may motivate the credit growth and asset prices which may help macroeconomic stability. Also, the macro prudential instruments those are designed to control credit market cycles could be helpful. Contrary, similar and rigid policies increase the policy error risks which negatively affect macroeconomic stability. Assenmacher-Wesche and Gerlach (2008) have investigated the responses of house and equity prices, inflation and output to monetary policy shocks in 17 countries, using quarterly data spanning 1986–2006. Findings present that the effect of monetary policy on housing prices is about three times as large as its impact on GDP. Increase in short-term interest rates by 25 basis points decrease real GDP by about 0.125%, and real housing prices by about 0.375%, after one or two years. Goodhart and Hofmann (2002) showed that for the conduct monetary policy, CPI inflation and future demand are determined by exchange rate and property and share prices in G7 countries. In the UK, as a sample country, the authors concluded that disregarding asset price changes leaded to inflation and output gap. Gupta and Kabundi (2010), using quarterly data spanning the period from 1976:Q1 to 2005:Q2, have investigated the impact of monetary policy shock on housing price inflation in the US. Findings show that housing price inflation responds negatively to a positive monetary policy shock. Cajias and Ertl (2017) investigated the relationship between housing prices and interest rates for the Nordic countries such as Finland, Sweden, Norway and Denmark. They found out that some changes in monetary policies of Finland, Sweden and Norway had an important role of changes in housing prices. Iacoviello (2005) also estimated a VAR to analyze the impact of monetary policy shocks on housing prices. The author estimated a VAR in inflation, house prices, inflation and interest rates by using data set for 1974-2003. He concluded that demand shocks motivate housing and nominal prices to move in the same direction. Besides, they are amplified as time goes by. The position of financial accelerator is not always the same for every situation. Nominal debt reduces supply shocks which help to stabilize the economy under interest rate control. And also, collateral effects courage the response of aggregate demand to housing price shocks.

On the other hand, in some studies, contrary findings also handled. Negro and Otrok (2007) have investigated the effect of monetary policy on housing prices using quarterly data from the US between the years 1986 to 2005 by Bayesian methods. The authors concluded that impact of expansionary monetary policy shocks on housing prices is very small. Gupta, Jurgilas, and Kabundi (2010), using quarterly data set for the period of 1980:Q1 to 2006:Q4, have investigated the impact of monetary policy on real housing price movements in South Africa. The results showed that a positive monetary policy shock had a negative impact on the real housing price growth. Eickmeier and Hofmann (2013), using quarterly data spanning 1987 – 2007 have investigated the interaction between monetary policy and more than 200 financial and asset variables in the U.S. They have showed that the impact of monetary policy shocks on housing prices is insignificant.
4. The Data Set
CBRT (the Central Bank of the Republic of Turkey) has a wide range of tools concerning money policy applications. These tools are, one week-repo rate, overnight borrowing and lending money interests and also the differences between the two (interest corridor) and required reserves. In this study, inter-banks interest rate is used to represent the Central Bank’s political tool. For housing prices; the Housing Unit price series, calculated by the Central Bank, spanning 2010M1-2016M3 are used. Housing unit price is calculated by Housing price per square meter.

Housing prices affect both household’s demand for housing and also companies’ non-residential housing demand through Tobin Q theory. In this study, the total price of the house that is calculated according to construction permits (buildings which are used for residing with two or more flats) represents household house demand. Besides, total building price in accordance with the building permit series is used in order to represent the housing demands of companies which are preferred in order to have housing investment. To represent production volume, the index of total industrial production has been used. To represent inflation series, CPU (Consumer Price Index) series have been used. The data have been taken from CBRT and TUIK (Turkish Statistical Institute) web sites. Because of data limitation, the selected period has only covered from 2010M1 to 2016M3. The data set is shown in Table 1.

Table 1: Variables

<table>
<thead>
<tr>
<th>INF</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPI</td>
<td>Housing price Index</td>
</tr>
<tr>
<td>IPI</td>
<td>Industrial Production Index</td>
</tr>
<tr>
<td>ON</td>
<td>Overnight Interest Rate</td>
</tr>
<tr>
<td>RES</td>
<td>Residential House Expenditure</td>
</tr>
<tr>
<td>NONRES</td>
<td>Nonresidential House Expenditure</td>
</tr>
</tbody>
</table>

5. Methodology
The studies which examine the efficiency of monetary transmission mechanism, mostly prefer methodology of VAR (Monte Carlo simulation). Variables in VAR methodology simultaneous equation systems are assumed to get affected by both their self and previous values of other variables. Thus, all data in simultaneous equation systems take part as endogenous variable. In this study, the process of housing prices channel which was revealed by Mishkin (1995) will be examined by using VAR methodology. Simultaneous models which have taken part in Equation (1) are used to explain the VAR analysis:

\[ y_t = b_{10} + \sum_{i=1}^{p} b_{1i} y_{t-i} + \sum_{i=1}^{p} b_{12} z_{t-i} + \varepsilon_{1t} \]

\[ z_t = b_{20} + \sum_{i=1}^{p} b_{21} y_{t-i} + \sum_{i=1}^{p} b_{22} z_{t-i} + \varepsilon_{2t} \]  \hspace{1cm} (1)

If equation is written in matrix form, equation (2) could be attained.
If equation (2) is written in a simpler way, equation (3) could be attained.

\[ y_t = c + \sum_{i=1}^{p} A_i y_{t-i} + \epsilon_t \]  

The estimate results obtained from VAR analysis cannot be interpreted directly. In this context, analysis of impulse response and variance decomposition analysis can be used to interpret the relation between the series. With impulse-response analysis, it is targeted to measure the reactions of other variables for each shock emerging from endogenous variables. With the variance decomposition analysis, it can be seen what percent of changes emerged by itself and what percent of changes emerged from other variables in emergent variations.

Using non-stationary series in time-series analysis could cause spurious regression. Therefore, first of all, stationarity of series will be examined. For this purpose, commonly used ADF (Augmented Dickey Fuller) and PP (Phillips-Peron) tests are preferred. ADF test was developed by Dickey-Fuller (1981) and PP test was developed by Phillips and Peron (1988).

In analysis period, there might be a structural break which is caused by the Global Crisis. A structural break can affect intercept; trend and both intercept and trend of series. By examining the stationarity of series with unit root tests which ignore the structural break, conventional test methods tend to accept the main hypothesis. Consequently, it may cause to get wrong results. Therefore, to examine the structural break which series contain, Zivot Andrews (1992) test has been used. Perron claims that macroeconomic time series cannot be characterized with a unit root and also states that the fluctuations in series are temporary. With the results of unit root tests which ignore the break, Perron’s (1989) study shows that some of the series which were seen as difference stationary have become trend stationary with a structural break. Zivot Andrews test have benefited from the assumptions Perron’s (1989) test. However, contrary to Perron test, in Zivot Andrews test; structural break is not accepted as exogenous but determined as endogenous (Perron, 1989; Zivot and Andrews, 1992). In Zivot Andrews test, three models are used to examine the situation of stationarity of the series. These models are as follows (Zivot and Andrew, 1992):

Model A:
\[ \Delta y_t = \mu + \alpha y_{t-1} + \beta t + \theta_i DU_i(\lambda) + \sum_{j=1}^{k} c_j \Delta y_{t-j} + e_t \]  

Model B:
\[ \Delta y_t = \mu + \alpha y_{t-1} + \beta t + \gamma_i DT_i(\lambda) + \sum_{j=1}^{k} d_j \Delta y_{t-j} + e_t \]  

Model C:
\[ \Delta y_t = \mu + \alpha y_{t-1} + \beta t + \theta_i DU_i(\lambda) + \gamma_i DT_i(\lambda) + \sum_{j=1}^{k} d_j \Delta y_{t-j} + e_t \]  

In model A, break only is seen in the average (intercept) of series. In model B, break is seen only in trend. Model C, break is seen both in stationary and in trend. t (1,2,3, …) in models indicate period number. TB is time of fraction.
In the equations, $DU_{\lambda}(\lambda)$ and $DT_{\lambda}(\lambda)$ artificial variables show the break in intercept and trend respectively. For $DU_{\lambda}(\lambda)$ dummy variable, when $t > TB$, $DU_{\lambda}(\lambda) = 1$, in other cases $DU_{\lambda}(\lambda) = 0$. On the other hand, for $DT_{\lambda}(\lambda)$ dummy variable, when $t > TB$, $DT_{\lambda}(\lambda) = t - TB$ otherwise its value is 0 (Zivot and Andrews, 1992).

In Zivot Andrews test, an exogenous structural break occurs at time $1 < T_B < T$ versus the alternative hypothesis that the series is stationary about a deterministic time trend with an exogenous change in the trend function at time $T_B$.

6. **Empirical Findings**

Before VAR analysis, the stationarity of the series was investigated. The results of ADF and PP tests are shown in the Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Intercept</th>
<th>ADF Int. and Trend</th>
<th>PP Intercept</th>
<th>PP Int. and Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>-0.538</td>
<td>-3.178</td>
<td>-1.126</td>
<td>-2.404</td>
</tr>
<tr>
<td>HP</td>
<td>3.546</td>
<td>-3.139</td>
<td>2.841</td>
<td>-2.890</td>
</tr>
<tr>
<td>RES</td>
<td>-1.630</td>
<td>-7.251*</td>
<td>-3.404*</td>
<td>-7.270*</td>
</tr>
<tr>
<td>NONRES</td>
<td>-2.410</td>
<td>-5.240*</td>
<td>-2.741</td>
<td>-5.240*</td>
</tr>
<tr>
<td>IPI</td>
<td>-2.607</td>
<td>-4.343*</td>
<td>-2.757</td>
<td>-4.293*</td>
</tr>
<tr>
<td>INF</td>
<td>-2.713</td>
<td>-2.696</td>
<td>-2.713</td>
<td>-2.696</td>
</tr>
</tbody>
</table>

*Note: The lag length is determined by Schwarz information criteria in ADF test. Newey-West band-width selection is used for PP test. * indicates stationarity at 1% level, **indicates stationarity at 5% level.*

Table 3 indicates that while RES, NONRES and IP series are trend stationary, others are difference stationary. However, Zivov Andrews test is applied in order to investigate stationarity of series, taking structural breaks in the relevant time period into account.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model A Min.t Statistic</th>
<th>Model A Breaking Period</th>
<th>Model C Min.t Statistic</th>
<th>Model C Breaking Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF</td>
<td>-4.135</td>
<td>-</td>
<td>-4.244</td>
<td>-</td>
</tr>
<tr>
<td>RES</td>
<td>-7.997</td>
<td>58</td>
<td>-8.19</td>
<td>58</td>
</tr>
<tr>
<td>NONRES</td>
<td>-6.357</td>
<td>40</td>
<td>-7.255</td>
<td>42</td>
</tr>
<tr>
<td>HP</td>
<td>-4.024</td>
<td>-</td>
<td>-3.416</td>
<td>-</td>
</tr>
<tr>
<td>IPI</td>
<td>-7.997</td>
<td>52</td>
<td>-8.019</td>
<td>54</td>
</tr>
<tr>
<td>ON</td>
<td>-4.808</td>
<td>11</td>
<td>-4.83</td>
<td>11</td>
</tr>
</tbody>
</table>

*Critical Values for Model A respectively 1%, 5% and 10% -5.34, -4.8 ve -4.58. For Model C %1, %5 ve %10; -5.57, -5.08 and -4.82.*

Given the results of Zivot Andrews test, according to C model, RES, NONRES, IPI and ON series are stationary with structural breaks in both intercept and trend. On the other hand, INF and HP series are seen becoming stationary on first difference. The structural breaks and the stationarity of series are modeled on the basis of relevant model and breaking date. In the VAR
analysis, identifying the correct lags affects the result. Hence, the optimum lags are estimated with LR test, which shows that the proper lag is nine. The results of the impulse response function analysis with the proper lags estimates based on VAR analysis are shown in Figure 1 and Figure 2.

**Figure 1: Impulse Response Function Results (Residential House)**
According to the results of the impulse response function analysis in Figure 1, when there is a positive shock in short-term policy interest rates, a negligible decrease is seen in the housing prices. Against the shock in the interest rates, in the first month, demand for residential house increases and in the 5th month, a decrease in the industrial production index occurs. No impact on inflation rate is monitored. In Figure 2, as a reaction to a positive shock in the political interest rates, housing prices decrease significantly. There is an increase in the investments in the (non-residential) construction. However, no increase in industrial production and inflation is evident. It is investigated whether VAR model has autocorrelation or not. The fact that all
the roots remain within the unit circle indicates that VAR model is lack of autocorrelation, and thus stationary. Test results are attached.

Along with the crisis in the global markets, has the increasing liquidity caused the rupture of the relationship between short-term interest rates and housing prices? Providing an answer to this question requires a method that allows the investigation of this causality relationship. First, “Autoregressive Distributed Lag” (ARDL) is used as a conventional co-integration test. Since ON series is trend stationary and HP series is stationary at first difference, ARDL is the most convenient model to analyze the long-term co-integration relationship. According to this model, it is evident that there is a long-term causality relationship between ON and HP series.

In other words, political interest rates are of the determinants of housing prices. Test results are attached. According to the unit root analysis of Zivot Andrews test results, ON series have a break in both intercept and trend. In ARDL co-integration test, this structural break has not been taken into account. In order to take structural break into account, Hatemi-J (2008) test, structural break co-integration test, is considered as useful. Hatemi-J (2008) is a version of Gregory and Hansen (1996) structural break co-integration test with two endogenous breaks. Hatemi-J (2008) allows two structural breaks in both trend and intercept with respect to the investigation of relations between series. Accordingly, the results show that there is a long run causality relation between the series in 10% significance level. Test results are attached. When the results of co-integration analysis are taken into account, existence of a long-term causality relation between political interest rates and real estate values in Turkey’s economy is evident.

7. Conclusion
Turkish housing market has been growing rapidly since 2000s even though there were some crises in Turkey. This growing market will probably support Turkey’s economy in the long-term. Accordingly, we aimed to find out the effects of monetary policies on housing prices because growth of housing market is also influenced by monetary policies. With the help of VAR methodology, the data were analyzed for period of 2010 and 2016. The results show that the housing price channel has been partially effective. It is known that the policy used to counter the 2008 Global Financial Crisis has led to an abundance of liquidity. The loss of causality relationship between short-term interest rates and housing prices ultimately leads housing price channel not to operate effectively. In VAR analysis, the relationship between overnight interest rates and housing prices could not be presented strongly. As a result, co-integration tests have been estimated in order to show the relationship between short term interest rates and housing prices. In addition, there is a relationship that does not take the breaking into account and that there is a long term relationship between breaking co-integration tests. So, this study contributes the argument that the policy makers who try to improve the economic performance of housing sector should not ignore the changes in monetary policy.

8. Discussion and Limitation
This study investigates the effects of monetary policy on housing prices for Turkish housing market as a sample of emerging market and results show that monetary policy is an important variable which influencing housing prices. In the literature, there are some other studies which used VAR analysis like our study. For example, Iacoviello (2005), Aspachs-Bracons and Rabanal (2011) and Fratantoni and Schuh (2003) used VAR analysis to test effect of monetary policy on housing prices. In addition, studies including other emerging economies, has shown similar results with this study. Xu and Chen (2012) determined that monetary policy had a significant effect on housing prices in Chinese housing market. Pedram, Shirinbakhsh and Afshar (2011) determined that monetary policy influenced consumption and residential...
investments in Iran. Mallick (2011) investigated the relationships between monetary policy, construction sector output and housing prices in India and determined that commercial bank credit had a positive effect on construction sector growth. The limitations of the study are as follows: First, this empirical study investigated only Turkish housing market, but neglected the other housing markets. Second, there is a period limitation that we included data of period between 2010 and 2016. Accordingly, researchers should be careful about data collection and methodology when they investigate different country cases.

Note: This paper was presented with the title “The Effects of Monetary Policy on Housing Prices: The Case of Turkey” in International Congress of Management, Economy and Policy / ICOMEPE’17 in May 20-21, 2017 / Istanbul - TURKEY

REFERENCES

- Eickmeier, S. and Hofmann, B. (2013). “Monetary policy, housing booms and financial


**APPENDICES**

**Appendix 1. ARDL Bounds Test (1,0)**

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>189.4873</td>
<td>1</td>
</tr>
</tbody>
</table>

Critical Value Bounds

<table>
<thead>
<tr>
<th>Significance 5%</th>
<th>I0 Bound</th>
<th>I1 Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.62</td>
<td>4.16</td>
</tr>
</tbody>
</table>

**Long Run Coefficients**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>0.044</td>
<td>0.014</td>
<td>3.078</td>
<td>0.003</td>
</tr>
<tr>
<td>C</td>
<td>5.966</td>
<td>0.206</td>
<td>28.825</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Appendix 2. Hatemi-J Co-integration Test Results**

<table>
<thead>
<tr>
<th>Test Stat.</th>
<th>Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>ADF</td>
<td>-5.769</td>
</tr>
<tr>
<td>Zt</td>
<td>-4.805</td>
</tr>
<tr>
<td>Za</td>
<td>-31.234</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>first break point, 22</th>
<th>second break point, 47</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Za</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3. Inverse Roots for VAR Analysis

2005-2016 Periods
Inverse Roots of AR Characteristic Polynomial

2010-2016 Periods
Inverse Roots of AR Characteristic Polynomial