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Demand-side factors of housing price increases in Turkey: Blanchard-Quah SVAR model

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Abstract:

A bubble in the housing sector is defined as an unprecedented upsurge in house prices which cannot be explained by fundamental determinants of the housing sector. This study examines demand-side factors of real estate sector in Turkey in order to expose whether house price increases in the country can be counted as a bubble. We use the Blanchard-Quah SVAR model to empirically reveal the relationships between the real mortgage interest rates, house price gap, price-rent-ratio and purchasing power parity. The results of the paper indicate that real interest rates and other variables have a significant explanatory power in the long run whereas house prices cannot be explained by these variables in the short run. Therefore it can be asserted that the house price increases in Turkey cannot be evaluated as a bubble in the long run.

JEL Classifications: C32, E27, E43, G12, R3

Keywords: Real estate, housing demand, real estate bubble, Blanchard-Quah, Turkey

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1. Introduction

Most of the developed countries, particularly the US, UK, Ireland, Spain and some East European countries, witnessed a sharp increase in house prices coming out in an environment of financial innovation, loosened monetary conditions, swift growth in credit aggregates, lacking risk management and a substantial increase in leverage. The distress in the subprime mortgage market in the US in 2007 constituted one of the main signals of switching from boom to bust cycle, which was ultimately followed by a global financial crisis. The sequence of events in financial markets ahead of the crisis has had common features with the past crises. However, the origin of the last one had some distinctive characteristics in that the housing sector had the foremost role in the crisis through mortgage loans (Claessens et al, 2010). Accordingly, the crisis is usually referred as a subprime crisis.

Both the policymakers and academic circles have paid much attention to the developments in housing market particularly since the outbreak of the global crisis. As the housing constitutes the largest part of the housing investment portfolio, the housing market-originated crisis triggered by a sharp fall in house prices has had prevalent and enormous effects on both macroeconomic variables and also social developments in many countries. A sharp decrease in house prices in the phase of burst leads to a fall in the value of their investment while the repayment due to mortgage credits remain higher. Additionally, slump in the prices induces a decline in the construction sector, which constitutes a large part of the GDP in many economies, leading to a rise in unemployment

in the economy. On the other hand, some financial deregulation policies enabled many households to find funds for the purchase easily. Housing is largely financed by mortgage credits issued by financial institutions, which use them as collateral for their financial investments. At the center of the global crisis, there lies these institutions' misperception about the risk and their motivation in loosening the lending criteria. The compound effect of deterioration in credit and housing market endanger the overall economic activity in the interconnected global economic system. Thus, severe fluctuations in the housing sector, defined as boom and bust cycles, are associated with cumulative effects on the overall economy.

The global housing prices have kept rising by 5.3% in the first 3 quarters in 2016 so that it has reached its highest value for two years according to The Knight Frank Global House Price Index, expressing the current aspect of the potential risk of the bubble. One of the main concerns for examining this kind of turmoil is to determine the house price bubble by distinguishing the bubble from the rise in housing prices due to some frictions in supply and demand conditions in the market. The issue is particularly crucial for policy makers to determine the appropriate policy tool to react against the turmoil. Similarly, the main reason behind this severe financial distress is also a nonconsensual issue. It is discussed among scholars and policymakers whether the subprime crisis is a clear result of FED's expansionary monetary policy leading a decrease in the cost of the mortgage and an increase in demand for housing or whether it is related to the irrational expectations of households and investors for further increase in prices when current prices are high, which is called as "irrational exuberance".

This concern is also important for Turkey since the country has experienced record rise in house prices especially in metropolises from the period of 2003. This upsurge in house price brought about a question whether this process can be defined as a real estate bubble or it should be assessed within the rational market conditions. The housing prices in Turkey is still remarkable in the global scale, moving up the country to the top ranking of the listed countries with a rise of 13.3% annual growth in the first quarter of 2017 (The Knight Frank Global House Price Index). In this paper, we intend to analyze whether we can state that Turkey has experienced a real estate bubble investigating the effects of the demand side factors on the housing market. The focus of the paper is directed towards the demand side factors of the housing price increases due to the lack of the data on the supply side factors in Turkish construction sector. Accordingly, the paper intends to expose the magnitude of the demand side factors in Turkish housing markets. On the other hand, we intend to forecast the endogenous variables in the model. We use the SVAR model based on Blanchard-Quah restriction criteria using quarterly data from 2003:Q3 to 2015:Q4. We obtained the data from REIDIN and the Central Bank of Republic of Turkey.

The housing market in Turkey has not been investigated enough due to the lack of data though the real estate is seen as an attractive investment field globally. The main contribution of our study is that the study uses Blanchard-Quah model allowing long term restrictions on variables in order to comprehend the issue in parallel to economic theory. This is the first study analyzing the demand side factors of the housing market in Turkey which uses the longest time period as far as we know. The other contribution is that this is also the first study to forecast the future value intervals of variables until 2023.

The remainder of this paper is organized as follows. Section 2 defines a house price bubble. Section 3 explains the determinants of a bubble. Section 4 describes some indicators for real estate market in Turkey. Empirical results and findings of the paper are discussed briefly in Section 5. Section 6 presents the empirical results and Section 7 summarizes the major findings of the paper.

2. Defining a house price bubble

A continuous and sharp rise in an asset demand associated with the unprecedented upsurge in that asset price is often defined as asset-price bubble. The definition reflects some kind of market behavior, which has been observed as self-fulfilling and unrelated with fundamental conditions of evaluation of the asset.

As put forward by Meltzer (2002), what is called as a bubble is some kind of events, which cannot be explained by standard hypotheses. Likewise, an asset-price bubble is generally associated with a mispricing of asset values, divergence of asset prices from those which are set according to rational expectation of cash flows of assets (Malkiel, 2010; Scherbina, 2013). In this respect, asset price bubbles are broadly categorized as rational and non-rational bubbles. The first category, rational bubbles, is related to a rational demand by investors for a rise in asset prices, which they consider as a compensation for the predicted loss from the probability of a burst. In this case, the investors are aware of the bubble (Flood & Hodrick 2008). The latter category, non-rational bubble, which is called "mania" by Minsky (1982), refers overstated and biased expectations by investors about an investment boosted by new innovations and facilities in that investment field.

As is evident in asset theory, the price of any asset should be equal to the present value of all future expected cash flows (Campbell & Shiller, 1987). The definition emphasizes two important points: the expectation of cash flows and the rate used to discount these cash flow expectations, which are not rational (Siegel, 2003). Accordingly, if the realized return is more than two standard deviations from the expected return, then an operational bubble can be detected (Siegel, 2003). The initial rise in asset prices is observed as generating further rises in expectations and attracting new buyers- generally speculators interested in profits from trading in the asset rather than its use or earnings capacity (Siegel, 2003).

Although the real estate market has often realized as having similar features with other asset markets particularly in terms of pricing, there is no clear and common definition of the bubble in that market. However, Thornton (2009) specifies three general views related to the different point of views of schools of economic thoughts. Accordingly, the classical and supply side economists excluded the existence of a bubble itself as they acknowledged that the distortions in housing market come from the real factors. On the other hand, the proponents of Keynesian view are inclined to relate the bubble to psychological factors called by Greenspan as "irrational exuberance." The Austrian school admit that the bubbles are motivated by psychological factors, which are affected and triggered by manipulations of monetary policy.

The views inclining to define the bubble often distinguish the fundamental part and bubble part of the sharp increase in house prices. Accordingly, the bubble is accepted as the deviation of prices from their fundamentals caused by over expectation of appreciation in future house prices, that is to say, there is no linkage between prices and fundamentals anymore (Flood & Hodrick, 1986; Flood & Hodrick, 1990; Case & Shiller, 2003). Behind this divergence of price increases there lies the belief that as long as the prices will continue to raise, the investors will be able to sell the house at a higher price in the future. This unsupported expectation results in higher prices without any realistic change in fundamentals until these self-fulfilling conditions no longer exist (Shiller, 2005; Lawrence, 2008). As a main non-fundamental factor urging price increases and as a key factor of a bubble, the physiological expectations is particularly emphasized by Stiglitz stating that a bubble exists "if the reason why the price is high today is *only* because investors believe that the selling price will be high tomorrow- when fundamental factors do not seem to justify such a price" (Stiglitz, 1990). The expectation-based aspect of the bubble breaks the relationship between asset price rising and fundamentals (or long run equilibrium) of the market price of that asset. Case & Schiller (2003) also highlighted the

expectation factor stating that real estate bubble primarily emerges from expectations of future price increases in the market rather than the changes in fundamentals.

Regardless of a clear definition, a bubble is separated out its very common characteristics of quite volatile house prices without any change in fundamental factors, skyrocketing in the phase of boom and bottoming out in the phase of burst.

3. Determinants of a bubble

As defined by Blanchard & Fisher (1989), an asset price is comprised of two components: a fundamental price and a bubble price. Although a bubble in real estate market may be basically defined as large deviations of housing prices from fundamentals, there remains an unclear consideration about how fundamentals of housing market can be determined and what are the effects of these fundamentals on house prices. Hence, likewise the definition of the bubble, there is no consensus on the determinants of the housing bubble. On the other hand, major surveys on the issue mention some prominent macroeconomic variables and some valuation ratios used in asset pricing models for detecting the existence of a bubble, such as price to income and price-to-rent ratios.

The valuation ratios, which are borrowed from the asset pricing models, are also used for major predictors signaling the existence of a bubble in the housing sector. One of the key indicator ratios is price-to-income ratio, namely the ratio of median house price to median household disposable income. The ratio chiefly reflects the relationship between house prices and disposable income, also indicating the affordability of average households for buying a house in the country. It is assumed that households spare rather fixed share of their income on housing (Gallin, 2006). Therefore, when the ratio rises over time, it shows that the increase in house price is proportionally higher than the increase in average household income, which means the overvaluation of house prices. The other commonly used ratio as an indicator of a bubble is price-to-rent ratio, measuring the relative cost of a buying house versus renting it. The rise in this ratio above its historical trend indicates that the cost of buying a house is more rapidly increasing than the increase in rent of that house. In fact, the high price-to-rent ratio is expected to direct households to renting instead of owning a house. However, if the ratio remains high for a long period of time, the expectation for further increases in house prices direct households towards buying house leading to further increases in house prices (Himmelberg, Mayer & Sinai, 2005; Andre, 2010). These ratios are generally expected to return to their long term average. However, large deviations in price-to-income and price-to-rent ratios from their historical trends may refer to over or under valued house prices.

The main determinants of housing prices are broadly classified into 3 groups: economic factors reflecting the demand and supply conditions of the market such as income growth, interest rates, market for other financial assets, housing stock, credit supply and financial innovations enabling the households to borrow from financial institutions (Girouard, Kennedy, Andre & Noord, 2006; McQuinn & O'Reily, 2008); institutional factors such as financial and taxation system; demographic factors such as urbanization, population and household size (Girouard, Kennedy, Andre & Noord, 2006).

The bubble exists when the fluctuations of house prices cannot be explained by their fundamental determinants, that is to say, when the fluctuations are not led by some frictions peculiar to the characteristics of the market. Accordingly, many studies tend to examine the house price bubble by developing some methods for estimating the fundamental price. Following neoclassical pricing theory, it can be inferred that fundamental prices are determined by supply and demand determinants of the housing market. If the fundamental prices can be explained by demand and supply determinants of the market, then a bubble is not detected.

Estimating a model of real house prices for the US data covering the period of 1950-1989, Peek & Wilcox (1991) indicated that price overvaluation may be justified by fundamentals

such as income, employment, demographic factors, after-tax mortgage rates and construction costs. Kennedy & Andersen (1994) summarize a number of determinants common to various house price booms in fifteen OECD countries for the period of 1970-1992 putting forward that expansionary monetary policy, tax deductions in interest income or heritage, financial liberalization and new mortgage structure leading to low initial payments are seen general features common to real estate bubble for this period. In their empirical work, Abraham & Hendershott (1996) examined the relationships between housing prices and fundamental variables such as real income, employment, after-tax interest rates and construction costs for the period from 1977 to 1992. They found that income, employment and construction costs have a positive effect on house prices whereas housing prices are negatively correlated with interest rates. These fundamentals explain housing price overvaluation in some cities, but do not justify overvaluation in some others, indicating a price bubble. Englund & Ioannides (1997) study on fifteen OECD countries data set covering the period of 1970-1992. Their findings show that the house price's own lagged values, real GDP growth and real interest rates are significant for understanding house price dynamics. Similarly, in an attempt to explore the relationship between housing prices and fundamentals, McCarthy & Peach (2004) and Himmelberg, Mayer, & Sinai (2005) show that the increase in price-to-income ratios in the US since 1995 may be related to decrease in mortgage interest rates, demographic factors and supply conditions. Particularly, using structural housing models McCarthy & Peach (2004) indicated that for the period of 1995-2003, housing price increases can be explained by fundamentals such as higher income in 1990s and lower mortgage rates, that is, there is no housing bubble in that period in US. Using single equation model, Meen (2002) studied on the time series behavior of housing prices in US and UK in order to estimate the fundamental determinants of housing prices for the period of 1981-1998. He found that real housing prices, real interest rates, real disposable income, real net financial wealth and the housing stock are cointegrated variables. In contrast to these studies, which use traditional cointegration tests for the long run equilibrium relationship, adopting panel data test for the 95 US metropolitan areas over 23 years, Gallin (2006) found no cointegration between housing prices and various fundamentals including income. Case & Shiller (2003) conducted an extensive survey on home owners in US in 2002, besides their models estimating fundamentals of housing prices. The authors concluded that the home owners were not aware of the fundamental dynamics of the housing market and their behaviors were guided by their unrealistic expectations over house prices in the future, suggesting that bubble exists due to irrational house pricing and speculative investments in housing market. Anundsen & Jansen (2013) investigated the linkages between housing price and its short and long run determinants in Norway for the period 1986-2008 using structural VEC model. According to the results of the paper, authors put forward that housing prices are in relation with household borrowing, real disposable income, real interest rate after tax and housing stock in the long run. The other result of the paper is that household debt depends on the value of housing capital, housing turnover and real interest rates. Besides, housing prices and household debt are found to be mutually dependent variables which refer that increase in housing prices leads to a rise in household debt generating further increase in house prices. More recently, Anundsen (2015) examined the relationship between house prices and fundamentals such as rents and user costs for the subperiods of 1975:Q1-2010:Q4 in US housing market employing VAR models. The result of the study indicates that until 2002:Q4, house prices and fundamental variables are cointegrated variables, though this relationship disappears after that period.

The monetary policy associated with low real interest rates and expansion in credit markets has been attributed a distinguished role in the latest housing sector disturbances, as emphasized by seminal papers of Mishkin (2007) and Taylor (2007). The excess liquidity or credit expansion is a common indicator of a bubble. Boom phase is generally accompanied by growing credit usage and subsequently non-performing loans. Lyons & Muellbauer (2013) investigated the relationship between housing and credit markets in Ireland for the period of 1980Q1-2012Q4 adopting VEC model. The results of the paper

also highlights the effects of the developments in credit markets on asset prices after financial liberalization, suggesting that the credit growth put higher pressure on housing prices in Ireland. Likewise other investment units, demand for real estate is motivated by lower interest rates associated with financial mortgage innovations decreasing the cost of the credit and raising the house prices (Taylor, 2007). As the part of interest payments out of the household income is increasing, this may indicate a bubble in real estate market. Ayuso, Blanco & Restroy (2004) pointed out the importance of the strong negative relationship between real interest rates and housing prices stating that in Spain as the cost of financing the house decreased with the entry in Eurozone, house prices tended to increase rapidly. This was the case in some other European countries before they joined the EU (Egert & Mihaljek, 2007). McCarthy & Peach (2004) stated that lower nominal mortgage interest rates increase the affordability of houses even with a considerable rise in house price. The result indicates that house prices are in accordance with a decline in mortgage rates and a rise in income, that is to say, no bubble exists since price overvaluation can be justified by the changes in fundamentals.

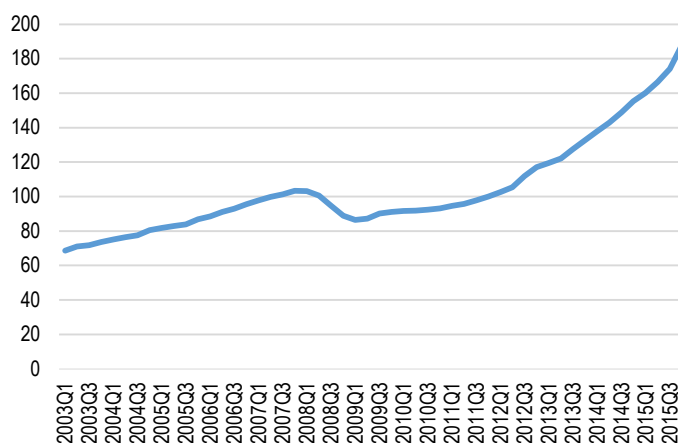
On the other hand, the issue is rather new for Turkey obviously due to the limited data availability, therefore few studies were conducted to investigate whether house price overvaluation in Turkish housing market can be defined as a bubble. As one of the very first attempts to detect the existence of a bubble in Turkey, Binay & Salman (2008) aim to answer three questions on their paper: (i) whether Turkey has experienced real estate bubble; (ii) what implications of real estate credit expansion would be on credit risks (iii) to what extent they observe wealth effects derived from real estate price increases (Binay & Salman, 2008). They use a panel data model for the period of 2000-2005 for 30 districts of Ankara. Their study includes a comparison of price-to-income and price-to-rent ratios in Turkey with other countries' ratios putting forward that the housing market in Turkey is relatively much more away from a bubble condition. Considering high economic growth rates in Turkey for 16 successive quarters, they conclude that increase in house prices cannot be evaluated as a bubble in real terms in the market. Since the share of the real estate credits is only 2.5% of GDP in 2008, the credit risks can be manageable in the banking sector. Finally they found a positive relationship between households' real estate wealth and consumption level. One percent increase in real estate wealth leads to 0.2 percent increase in total consumption. In sum, the authors point out that these developments in the market are not alarming in Turkey. Comparing financial indicators such as housing credit, share of housing credit to GDP in Turkey with industrialized countries, Coskun (2013) concluded that there would be no probability of a financial crisis driven by housing credits in Turkey. In an attempt to determine dynamic causal relationship between housing market activity and six fundamental determinants, Hepsen & Kalfa (2009) employed Granger causality test, impulse response functions and variance decomposition models for the period of 2002 and 2007. The results of causality test indicate that industrial production index is Granger causality of construction permits without feedback, while interest rates and mortgage loans are observed for feedback effects. Finally, the largest variance in construction permits appears to source from industrial production index, followed by an increase in the volume of mortgage loan and a decrease in interest rates. Kargı (2013) examined the relationship between economic growth and housing acquisition in Turkey by employing correlation relations, ADF unit root test, Granger causality and multiple regression models for the period of 2000- 2012. The results of the paper indicate that the credit expansion is largely related to GDP growth, lower interest rates and inflation, implying that there exists no bubble in real estate market in Turkey. Employing VEC model for the period of 2007-2012, Erdem & Varlı (2014) studied on the impacts of fundamental factors on demand and supply conditions in Turkish real estate market. They concluded that housing market, interest rates, GDP and housing prices are cointegrated variables. More recently, Erol (2015) investigated whether the recent house price increases can be explained by economic indicators. The result of the paper suggests that the surge in house prices can largely be

explained by fundamental economic and demographic indicators and housing market variables, concluding that there is no bubble in Turkish housing market.

4. Some indicators for real estate market in Turkey

In accordance with the record growth rates in Turkey for about last several years, construction sector has experienced large upsurges. In the last decade, the country witnessed historically record levels in housing market in terms of both house sales and house prices. The Turkish economy in 1990s was characterized by a spiral of high public debt, interest rates and inflation, which avoided the development of housing sector with its inverse effects on demand for housing credits and uncertainty. The reforms in fiscal and financial systems following the 2001 crisis accompanied by the expansion of global liquidity have accelerated the developments in the sector through lower costs of borrowing. On the other hand, the fast growth in the housing sector have raised some concerns about the issue whether the house price increases in Turkey can be explained by fundamental factors or it should be attributed to a price bubble, which urged the need for monitoring some market indicators more closely.

FIGURE 1. HOUSE PRICE INDEX IN TURKEY



Source: REIDIN.

The house price index have been recorded and published by both REIDIN and Central Bank of Republic of Turkey, which has published the data on real estate since 2010. According to the price index published by REIDIN, which we have filtered using Hodrick-Prescott in order to remove cyclical fluctuations, house prices followed an increasing path after the 2001 crisis. The high growth rate path in Turkey after the 2001 crisis accelerated the construction sector with the growth of domestic demand. The Figure 1 plots that the house prices have steadily increased, except the period of 2008:Q1-2009:Q1, when the global crisis had been effective in Turkey. In this period from 2003 to 2015, the average growth in house prices were 15% annually. After 2010, house prices have tended to increase steadily with a momentum in 2012 when legal adjustments on urban transformation became effective. The unprecedented increase in urban

transformation projects may particularly contribute to increases in the second-hand house prices and also housing rents, which together may contribute to increase housing prices.

FIGURE 2. MORTGAGE CREDITS

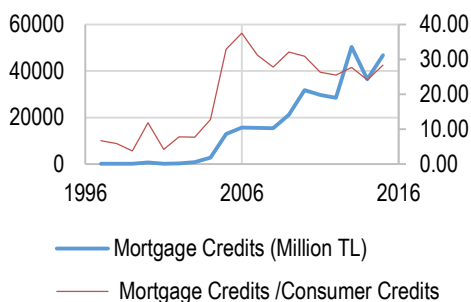
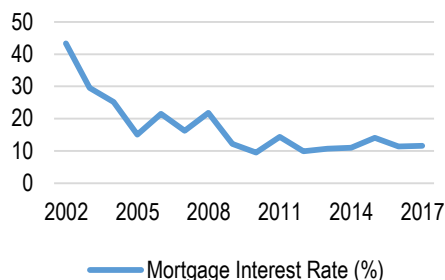


FIGURE 3. NOMINAL MORTGAGE VOLUME INTEREST RATE (%)



Source: CBRT.

In order to investigate housing price bubble, mostly used ratios, price-to-income and price-to-rent ratios, should also be regarded in Turkey as a possible indicator of a bubble. An average income increased by 5.3% while rents rose by 17% in last 10 years, according to Turkish Statistical Institute and CBRT.

The upsurge in housing demand has been accompanied by growing household debt in terms of credit usage. Figure 2 shows that expansion in credit used by households increased from 673 million TL in 2000 to approximately 47 billion TL in 2015. This rise can be detected through the rise in the ratio of mortgage credits to total consumer credits rising from 7.78 in 2002 to 32.92, 30.89, 24.15 and 28.34 in 2005, 2010, 2014 and 2015, respectively. The Figure 3 illustrates that the mortgage rates have a declining trend from 2003 to 2015 with a dramatic decline starting from 2003:Q1. While in 2003, the nominal mortgage interest rates were approximately 49%, this ratio continued to decline to 14.5% in 2006 after the economic reforms introduced in the "Turkey's Transition Program: Strengthening the Turkish Economy". The declining trend has an ongoing path except incremental increases.

5. Empirical model

After Sims' influential work (1980), the use of VARs has become very popular in empirical studies of macroeconomics. However, employing the VARs for modelling real estate market in Turkey is a quite new methodology due to the lack of the time series of fundamental variables for construction sector such as house prices index, price to rent ratio etc. Our empirical approach based on a structural VAR analysis proposed by Blanchard & Quah (1989) makes use of long run restrictions based on the economic theory in order to identify structural shocks. The aim of the study is to show up whether the demand side factors of house prices affect the price surges in Turkish housing market since 2003 and to forecast the price path in the near future. That Turkey, particularly in metropolitan cities such as Istanbul, Izmir, Antalya and Bursa, has experienced rapid price increases in the housing sector is one of the hot discussing topics about existence of real estate bubble in the country. From this point, if demand side factors have some

explanatory power over increases in prices, then we can conclude that there might not be a bubble in the sector.

5.1 Data

Blanchard-Quah SVAR model is estimated quarterly for the period from 2003:Q3 to 2015:Q4. The variables used in the model are *gap*, *rmir*, *ppi* and *prr* reflecting variations of prices from long term trends, real mortgage interest rates, purchasing power index, price-to-rent ratio respectively. The series of *ppi* and *prr* are expressed in percentage changes. The variations of house prices from trends, *gap*, is obtained by calculating the difference between house price index and its value filtered by Hodrick-Prescott. This series shows the overheating or cooling down of the economy, on which we focus in this study. In the economic literature the magnitude and sign of *gap* is acknowledged as giving an insight about price behaviour in the market. The positive *gap*, which means the current prices are above the economic trend, casts a doubt on a bubble in the housing sector. In Turkey, the *gap* series have a positive sign for related periods.

In Blanchard-Quah model the order of variables are matter due to the fact that the ordering affects the test result. In our model variable order is as follow: *rmir*, *ppi*, *gap* and *prr*. All series included in empirical analysis are sourced from REIDIN except real mortgage interest rates, *rmir* obtained from Central Bank of the Republic of Turkey (CBRT). Within this framework the empirical analysis is conducted by using JMulTi software version 4.23.

In order to avoid spurious regression problem all series of the model are needed to satisfy stationary condition. For this reason we employ the most accepted test in econometric literature namely Augmented Dickey-Fuller test (ADF). Then, we check the ADF test results with another unit root test, Phillips-Peron test that smooth the autocorrelation and homoscedasticity conditions.

$$\Delta y_t = \phi y_{t-1} + \sum_{j=1}^{p-1} \alpha_j^* \Delta y_{t-j} + u_t \quad (1)$$

In the regression models above, Δy denotes first differenced series $y_t - y_{t-1}$ and p is the number of the lagged differences. ADF test statistics is based on the t-statistic of the coefficient ϕ from OLS estimation. $H_0: \phi = 0$ versus $H_0: \phi < 0$ is tested. Critical values of the test depend on the deterministic terms, which have to be included. Therefore, different critical values are used when a constant or linear trend term is included in the test. If the null hypothesis is rejected, y_t is stationary whereas if the null hypothesis is accepted, y_t has a unit root and is non-stationary. A problem with ADF tests is that it requires including lagged differences of the variables in the model, which leads to a loss in degree of freedom and weak of the test procedure. The other problem of the ADF test is that it assumes error terms without autocorrelation and heteroscedasticity. On the other hand, Phillips-Perron test removes the restrictions on error terms in ADF tests (Phillips, 1987). In both tests, the null hypothesis is rejected when t statistic is above the critical values.

TABLE 1. AUGMENTED DICKEY-FULLER AND PHILIPS-PERRON TEST RESULTS

Variables	ADF test statistic	Deterministic terms	Lag length	Phillips-Perron test statistic
<i>mir</i>	-4.32*	constant, trend	4	-4.35*
<i>ppi</i>	-5.05*	constant	1	-4.72*
<i>gap</i>	-3.87**	constant	1	-3.50**
<i>pr</i>	-5.66*	constant, trend	0	-5.66*

Note: % 1 critical values for ADF test constant and trend and constant are 4.15, -3.57 respectively. % 5 critical values for ADF constant and trend are -3.50, -2.92 respectively. Critical values are from Davidson & McKinnon (1993, Table 20.1, p. 708). * - implies that H0 hypothesis that series has a unit root can be rejected by 0.01% significance level while. ** - implies that H0 hypothesis that series has a unit root can be rejected by 0.05% significance level.

All series used in the study have a nonzero mean and also linear trend except *gap* and *ppi*. Therefore ADF and Philips-Perron tests of *rmir* and *pr* are carried out for constant and trend terms, whereas they are applied to *gap* and *ppi* series for only constant term. For carrying out the unit root tests, the number of lagged differences in the regressions allowing a maximum lag length (p) of 10 is set by the Akaike Information (AIC) and Schwarz Criteria (SIC). As shown in Table 1, all series are stationary at % 1 significance level according to ADF and Phillips-Peron tests except *gap*, which is stationary at % 5 significance level.

5.2 SVAR model

The SVAR approach constitutes a good alternative to traditional a-theoretic VAR (Sims, 1980) since economic theory plays a key role in the modelling processes based on the approach. In reduced forms of VAR models, to constitution of a restriction matrix according to economic theory leads to some difficulties for interpreting the model results. In addition, changing results based on the order of variables in VAR models is another dispute about the model. For this reason, Sims (1986), Bernanke (1986), Shapiro & Watson (1988) tried to address these imperfections by introducing structural VAR models. A standard VAR approach assumes that the variables are stationary and includes only lags of all variables. A p^{th} -order Gaussian VAR model can be expressed as follows:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + CD_t + B_0 x_t + \dots + B_q x_{t-q} + u_t, \quad (2)$$

where $Ey_{t-j}u_t = 0$ for all j , $Eu_tu_t' = \Omega$. Above $y_t = (y_{1t} \dots \dots y_{Kt})'$ is a $(K \times 1)$ random vector of observable endogenous variables, D_t includes all deterministic variables such as a constant term, a linear term and dummy variables, $x_t = (x_{1t}, \dots, x_{Mt})'$ is a vector of M exogenous variables and $u_t = (u_{1t}, \dots, u_{Kt})$ is a K -dimensional unobservable zero mean. White noise or innovation process that is, $Eu_t = 0$, $Eu_tu_t' = \Sigma_u$ and $E(u_tu_t') = 0$. Finally, A_i , C and B_j are parameter matrices (Lütkepohl, 2005). If we drop all deterministic variables for simplicity, we obtain

$$y_t = \sum_{i=1}^p A_1 y_{t-i} + \sum_{i=1}^q \beta_i x_{t-i} + u_t \quad (3)$$

It is essential to identify the number of the lags in VAR(p) model. The lag order selection criteria include Akaike Information Criteria (AIC), Schwarz Criteria (SC), Hannan-Quin and Final Prediction Error Tests. AIC and SC are calculated as follows:

$$AIC = \frac{2pk^2}{T} + k(1 + \ln 2p) + \ln(\widehat{B}) \quad (4)$$

$$SC = \frac{\ln(T)pk^2}{T} + k(1 + \ln 2p) + \ln(\widehat{B}). \quad (5)$$

T is length of the sample while (\widehat{B}) is the estimates of residual error covariance matrix of VAR. The OLS methods can be used to calculate the consistent and efficient estimators of VAR model. After VAR model is established, an important part of the application is to analyze the causal relationship between economic time series (Sims, 1972).

According to Equation 6, the mean square error (MSE) of y_t ,

$$MSE = \frac{1}{s} \sum_{i=1}^s (\widehat{y}_{t-i} - y_{t+i})^2, \quad (6)$$

meaning that x does not Granger-cause y (Granger, 1969)

$$MSE = [\widehat{E}(y_{t+s} | y_t, y_{t-1}, \dots)] = [\widehat{E}(y_{t+s} | y_t, y_{t-1}, \dots, x_t, x_{t-1}, \dots)] \quad (7)$$

In order to test whether x_t Granger-cause y_t , we conduct an F test of the null hypothesis, that is

$$H_0: \beta_1 = \beta_2 = \dots = \beta_k = 0 \quad (8)$$

The F-test value Equation,

$$F = \frac{(SSE_y - (SSE_u)/k)}{(SSE_u/(T-kN))} \quad (9)$$

If test statistic is greater than 5% critical value for an F distribution, then we reject the null hypothesis, and conclude that y does Granger-cause x .

Since it is difficult to detect directly the relations between the variables from the parameter matrices, IRFs have been proposed as tools for interpreting VAR models (Lütkepohl, 2005). In VAR process, results of impulse response functions (IRFs) and forecast error variance decomposition (FEVD) provide a useful tool for analysing the relationships between variables. Impulse-response analysis is used to detect the dynamic interactions between the endogenous variables of VAR(p) process. More clearly, IRFs measure the effects of a shock in any error term occurred at $t=0$ on other variables n period later by the way of all individual error terms, holding all else constant. In other words, the functions are estimated to trace out the responsiveness of dependent variables in a VAR against a shock to each of the variables for the following periods. Because the correlation of error terms may indicate that a shock in one variable is likely to be accompanied by a shock in other variable. Setting all other variables to zero may give a misleading picture of the actual dynamic relations between the variables. Therefore impulse response analysis is often performed in terms of MA representation where the residuals are orthogonal (Enders, 2004). Thus, if there are K variables in the system, a total K^2 impulse responses could be generated (Brooks, 2008). If the process y_t is $I(0)$, then a VAR model IFRs can be derived from Wald moving average (MA) representation as shown below:

$$y_t = \Phi_0 u_t + \Phi_1 u_{t-1} + \Phi_2 u_{t-2} + \dots, \quad (10)$$

Where I_K is ($K \times K$) identity matrix, $\Phi_0 = I_K$ and the Φ_s can be computed recursively as

$$\Phi_s = \sum_{j=1}^s \Phi_{s-j} A_j, \quad s = 1, 2, \dots, \quad (11)$$

where $A_j = 0$ for $j > p$. The responses to impulses hitting the system are reflected by the coefficients of the representation above. So IRFs are just the elements of the Φ_s matrices. The $(i, j)^{\text{th}}$ elements of the matrices Φ_s , are a function of s and trace the expected response of $y_{i,t+s}$, to a unit change in y_{it} , holding constant all the past values of y_t . The elements of Φ_s represent the impulse responses of the components of y_t with respect to the u_t innovations since the change in y_t given as $\{y_{t-1}, y_{t-2}, \dots\}$ is measured by the innovation u_t . Accumulated effects of the impulses are obtained by adding up the Φ_s matrices (Breitung, Brüggemann, & Lütkepohl 2007). The total long run effects are given below:

$$\Phi = \sum_{s=0}^{\infty} \Phi_s = (I_k - A_1 - \dots - A_p)^{-1} \quad (12)$$

If the components of u_t are instantaneously correlated, that is, if Σu is not diagonal, orthogonal innovations are preferred in an impulse response analysis (Lütkepohl, 2005).

Orthogonal innovations are obtained by using a Cholesky decomposition of the covariance matrix Σu . If P is a lower triangular matrix such that $\Sigma u = PP'$, the orthogonalized shocks are given by $\varepsilon_t = P^{-1} u_t$ (Hamilton, 1994).

$$y_t = \Psi_0 \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \dots, \quad (13)$$

where $\Psi = \Phi_i P$ ($i=0,1,2,\dots$). Sims (1980) made the assumption about orthogonalization of the reduced form innovations done through Cholesky decomposition, which needs a causal ordering relating to how the system works (Cooley & Leroy). $\Psi_0 = P$ is lower triangular so that an ε or one standard deviation shock in the first variable may have an instantaneous effect on all the variables, whereas a shock in the second variable cannot have an instantaneous impact on y_{it} but only on the other variables of the VAR model. As a result, in Cholesky decomposition different ordering of the variables in the vector y_t may produce different impulse responses (JMULTi Help System, 2008).

For identifying the shocks in an impulse response analysis, SVAR model can be used. Within this context, restrictions are imposed on the matrices A and B in the SVAR model form as shown below:

$$A_{yt} = A_1^* y_{t-1} + \dots + A_p^* y_{t-p} + B \varepsilon_t \quad (14)$$

The residuals are represented as $B \varepsilon_t$, ε_t is a $(K \times 1)$ vector of structural shocks with covariance matrix $E(\varepsilon_t \varepsilon_t') = \Sigma e$, which is specified to be an identity matrix. In any case, structural shocks are instantaneously uncorrelated. SVAR model has three types, an A model where $B = I_k$, a B model where where $A = I_k$, and a general AB model where restrictions can be placed on both matrices. For instance, the relation to the reduced form residuals is given by $Au_t = B \varepsilon_t$ in the AB -model.

Therefore, a SVAR model's impulse responses can be obtained from process (13) with $\Psi_j = \Phi_j A^{-1} B$.

If restrictions on the long-run effects are available, they may be placed on $\Psi = \Phi A^{-1} B$, Φ is the matrix specified in (12). For instance, the restriction implying that some shocks do not have any long-run effects is achieved by setting the respective elements of the long-run impact matrix $\Psi = \Phi_0 + \Psi_1 + \dots$ equal to zero (Breitung, Brüggemann & Lütkepohl, 2007, p. 167). Within this context, SVAR Blanchard-Quah model proposed by Blanchard & Quah (1989) exposes the long-run effects of shocks by placing restrictions.

In Blanchard-Quah model $A = I_k$, and the matrix of long-run effects; $(I_k - A_1 - \dots - A_p)^{-1} B$ is assumed to be lower-triangular. For instance, if a SVAR model contains three variables, the second residual has a zero long-run impact on the first variable, whereas the third residual cannot have a long-run impact on the first and second variables. Adjusting the order of variables may be necessary for ensuring that plausible restrictions are obtained. Estimation of Blanchard-Quah model is carried out by a Cholesky decomposition of the matrix $I_k - \widehat{A}_1 - \dots - \widehat{A}_p)^{-1} B \widehat{\Sigma}_u (I_k - \widehat{A}_1 - \dots - \widehat{A}_p)^{-1}$, where a hat indicates a reduced form estimated (JMULTi Help System, 2008).

Impulse response functions trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables, whereas variance decompositions offer a different method for examining VAR system dynamics. Variance decompositions give the proportion of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables. They determine how much of the h-step ahead forecast error variance of a given variable is explained by exogenous shocks to the other variables (Brooks, 2008).

FEVDs are popular tools for interpreting VAR models. Denoting the ij^{th} element of the orthogonalized impulse response coefficient matrix Ψ_n by $\bar{\omega}_{ij,n}$, the variance of the h-step ahead forecast error at forecast origin T , $y_{k,T+h} - y_{k,T+hT}$ can be expressed as below:

$$\sigma_k^2(h) = \sum_{n=0}^{h-1} (\bar{\omega}_{k1,n}^2 + \dots + \bar{\omega}_{kK,n}^2) = \sum_{j=1}^K (\bar{\omega}_{kj,0}^2 + \dots + \bar{\omega}_{kj,h-1}^2) \quad (15)$$

The term $(\bar{\omega}_{kj,0}^2 + \dots + \bar{\omega}_{kj,h-1}^2)$ is interpreted as the contribution of variable j to the h-step forecast error variance of variable k . When the above terms are divided by $\sigma_k^2(h)$, the percentage contribution of variable j to the h-step forecast error variance of variable k is obtained (JMulTi Help System, 2008).

$$\omega_{kj}(h) = (v_{kj,0}^2 + \dots + v_{kj,h-1}^2) / \sigma_k^2(h) \quad (16)$$

Thereby, variance decompositions determine how much of the h-step-ahead forecast error variance of a given variable is explained by exogenous shocks to the other variables (Ozcelebi & Yildirim, 2011).

6. Empirical results and analysis

In order to identify demand side sources of price increases in real estate sector in Turkey Blanchard & Quah (1985) method is applied to four variable VAR system.

In our study, Blanchard-Quah SVAR model is employed to analyze the relationship between house price and price-to-rent ratio, purchasing power and mortgage interest rate in long run for Turkey. Optimal lag lengths are determined by using Akaike Information Criteria (AIC), Schwarz Criteria (SIC), Hannan-Quinn Criteria (HQ) and Final Prediction Error. All of the information criteria suggest a lag length of nine for the SVAR model when to be searched up to ten lags of level. Thereby, it is implied that VAR(9) model is the most appreciate for the Blanchard-Quah SVAR model.

In order to identify the structural shocks of the SVAR model, long run restrictions are imposed. Since $n(n-1)/2$ restrictions must be imposed on analysis, we need to six restrictions for the model with four variables. The restrictions imposed in SVAR process as below:

- a) Three restrictions are imposed assuming that nominal shock attributable to purchasing power, price gap and price-to-rent ratio has no long run effect on the real variable, real mortgage interest rate;
- b) Two restrictions are imposed assuming that price gap and price-to-rent ratio have no long run effect on purchasing power
- c) Price-to-rent ratio has no long run effect on price gap in the model.

TABLE 2. CORRELATION MATRIX OF VARIABLES

	<i>rmir</i>	<i>ppi</i>	<i>gap</i>	<i>pr</i>
<i>rmir</i>	1	0.233	-0.148	0.761
<i>ppi</i>	0.233	1	-0.008	-0.157
<i>gap</i>	-0.148	-0.008	1	0.08
<i>pr</i>	-7.761	-0.157	0.08	1

Before running the VAR model we would like to obtain the correlation matrix of all variables to test preliminary insight about direction and relations between variables. As shown in Table 2, all signs of correlation matrix are coherent with the economic theory. There is a negative correlation between the cost of the credit with house price gap and positive correlation with price-to-rent ratio as theory put forward. On the other hand there is a negative correlation between house price gap and purchasing power index needs an attention for analysing. This incoherent sign casts doubt on threat a bubble on the prices in Turkey.

TABLE 3. GRANGER CAUSALITY TEST RESULTS

Cause variables	Effect variables	Test statistics	p-value
<i>rmir</i>	<i>ppi, gap, pr</i>	3.543	0.005
<i>ppi</i>	<i>gap, pr, ppi</i>	1.2856	0.3037
<i>gap</i>	<i>ppi, pr, rmir</i>	2.3231	0.041
<i>pr</i>	<i>gap, pr, rmir</i>	3.034	0.0118

After correlation relation, Granger causality test results are shown above. According to the Table 3, H_0 hypothesis that there is no causality between *rmir* and *ppi, gap, pr* can be rejected since p-value is smaller than 0.05. H_0 hypothesis can be rejected for all variables apart from *ppi*.

Definition of Granger causality did not imply anything about possible instantaneous correlations between variables. If the innovation to y_t and innovation to x_t are correlated then it can be said that there is instantaneous causality. As Table 4 illustrated that all variables have instantaneous causality to each other with 1% significance level apart from *rmir* since p-value of *rmir* is higher than 5%.

TABLE 4. INSTANTANEOUS CAUSALITY TEST RESULTS

Cause variables	Effect variables	Test statistics	p-value
<i>rmir</i>	<i>ppi, gap, pr</i>	3.463	0.3256
<i>ppi</i>	<i>gap, pr, ppi</i>	18.53	0.0003
<i>gap</i>	<i>ppi, pr, rmir</i>	14.753	0.002
<i>pr</i>	<i>gap, pr, rmir</i>	17.7601	0.005

Within this framework, SVAR model's IRFs are estimated to expose dynamic behaviour of the system. However, the results of IRFs seem statistically insignificant to comment on. For this reason in addition to IRFs, we would like to analyze FEVDs as shown below since FEVD shows the proportion of the variability of the errors share of variance due to a variable. If shocks do not explain none of the forecast error variance of at all forecast horizon it can be said that the sequence is exogenous.

TABLE 5. FORECAST ERROR VARIANCE DECOMPOSITION OF *gap*

Forecast horizon	<i>rmir</i>	<i>ppi</i>	<i>gap</i>	<i>pr</i>
1	0.05	0.12	0.80	0.03
4	0.25	0.12	0.62	0.02
8	0.27	0.17	0.52	0.04
12	0.29	0.16	0.47	0.08
16	0.34	0.14	0.43	0.10
20	0.29	0.17	0.42	0.12
24	0.29	0.16	0.39	0.15

Table 5 exposes the results of FEVD analysis for *gap*. FEVD results show that price *gap* has a self-feeding structure in the short run. It is noticeable that the contribution of *gap* over forecast error variance decomposition of itself is the highest of all four variables. It is also noticeable that *pr* has little effect on variance in house price *gap*. With respect to contribution of real interest rate, purchasing power index and price-to-rent ratio it can be said that purchasing power acts as the strongest factor in the short run, for first quarter, whereas real interest rate acts it in the long run following the *gap* itself. Explaining the one fourth of whole variance of *gap*, *rmir* has the most explanatory power among variables followed by *pr* with 21% and *ppi* with 17% in the long run.

TABLE 6. FORECAST ERROR VARIANCE DECOMPOSITION OF *rmir*

Forecast horizon	<i>rmir</i>	<i>ppi</i>	<i>gap</i>	<i>pr</i>
1	0.14	0.01	0.05	0.80
4	0.15	0.20	0.54	0.11
8	0.30	0.14	0.42	0.14
12	0.34	0.17	0.35	0.13
16	0.27	0.22	0.39	0.12
20	0.23	0.21	0.37	0.19
24	0.25	0.17	0.37	0.21

FEVD of *rmir* results can be seen from the table above. According to the Table 6 the change of variance of *rmir* may highly be attributed to *pr* in first quarters. However it is seen that the effect of *pr* on *rmir* diminishes dramatically until fourth quarter when the *gap* plays a key role for understanding the probability of *rmir* to have explanatory power by 50%. During the forecast horizon *ppi* has unchanged structure for explaining variance of *rmir*.

TABLE 7. FORECAST ERROR VARIANCE DECOMPOSITION OF *ppi*

Forecast horizon	<i>rmir</i>	<i>ppi</i>	<i>gap</i>	<i>pr</i>
1	0.02	0.87	0.02	0.09
4	0.05	0.35	0.37	0.23
8	0.20	0.16	0.46	0.18
12	0.24	0.17	0.41	0.18
16	0.22	0.17	0.43	0.18
20	0.23	0.18	0.38	0.21
24	0.25	0.19	0.37	0.18

In the first quarter, the variance of *ppi* has an autoregressive structure where 87% of variance is explained by itself. This structure starts to change in the 4th quarter and replaced by wealth effect one year later. The *gap*, which is varied from its long-term trend in the same period, explains 37% change of the variance of *ppi*. The effect of *ppi* on its own variance changes radically in this quarter reducing from 87% to 35%. The effect of *rmir* on the variance of *ppi* reveals in the 8th quarter accounting for ¼ change in *ppi*. After the 8th quarter, the main determinants of the change in *ppi* are *gap* with 37% and *rmir* with 25% while *ppi* and *pr* have approximately equivalent effect with 19% .

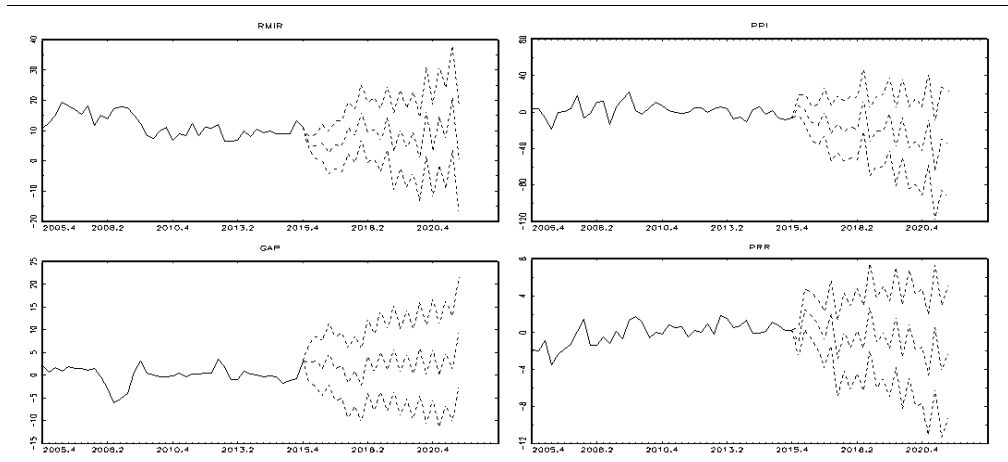
TABLE 8. FORECAST ERROR VARIANCE DECOMPOSITION OF *pr*

Forecast horizon	<i>rmir</i>	<i>ppi</i>	<i>gap</i>	<i>pr</i>
1	0.02	0.87	0.02	0.09
4	0.05	0.35	0.37	0.23
8	0.20	0.16	0.46	0.18
12	0.24	0.17	0.41	0.18
16	0.22	0.17	0.43	0.18
20	0.23	0.18	0.38	0.21
24	0.24	0.20	0.34	0.22

The variance of *pr* has similar features with *ppi*, mainly determined by *ppi* with 87% . Likewise, the change in purchasing power determines housing prices affecting housing demand. In the 4th quarter, the variance of *pr* is explained by *gap* with 37% and by *rmir* with 35% while the effect of *pr* on its own variance is determined with 23%. The effect of mortgage rates on the variance of *pr* reveals in the 8th quarter as is the case for *ppi*. For the forecast period, *gap* explains the variance of *pr* with 35-40% while *rmir*, *pr* and *ppi* account for the change in variance of *pr* with the explanatory power of approximately 20% .

Based on current data set, the forecast of the variables for 2023 horizon tells us that there would be a pressure on house price gap in near future and the gap would draw back to its 2014 level until mid of the 2018. From that date it shows a horizontal cyclical movement continuously until 2021. In last three years in forecast horizon house price gap would increase dramatically.

FIGURE 4. TIME SERIES FORECAST (CI=95%)



According to Figure 4, real interest rates have shown a decreasing trend between 2005 and 2006 while the rates would increase after 2018 and follow a volatile path until 2013. Actually, the Figure shows that interest rates will increase in 2017-2018; decrease between 2018-2020 with little fluctuations; and after 2020 it will fluctuate around a certain average, which will be close to the average of 2014. It is also striking that interest rates in 2005-2015 were more stable than the forecast period. One reason may stem from internal and external economic conditions such as rising inflation in the country and fed's monetary policy and the other ones may be related to domestic and foreign politics such as uncertainty about plebiscite on constitutional change and Trump's protective policies.

Purchasing power parity index will follow a decreasing path beginning from the mid of 2016 to 2018 with a negative value in 2017 indicating absolute decrease in purchasing power. Cyclical increases in the parity index do not represent an absolute increase in total *ppi*. The decreasing trend in *ppi* can be partly explained by volatility in real interest rates since *ppi* is constructed by considering the usage of credit for purchasing house. On the other hand, with the negative effect of 2009 global crisis on export revenue and GDP growth particularly for Turkey as a developing country in middle income trap, growth rates are below the potential rates while house prices continue to rise leading to an increase in cost of purchasing of house.

According to the Figure 4, the gap decreased after 2017 until the mid of 2018 while it is positively varied up to the 2021. The positive difference turns out to be clearer towards the end of 2021. The periodical change in house prices may be higher in a more volatile path, different from previous period. The only cease in price increases in the year of 2017 after when the price increase would accelerate. It is also seen from the figure that decrease in *gap* coincides with the period of rising interest rates, which may imply that the housing prices will be more sensitive to the interest rates. However, the positive correlation between decrease in purchasing power and *gap* will drift apart for the forecast period. Therefore, housing price increases may be considered as unsupported by increase in purchasing power.

The change in price-to-rent ratio may be in a decreasing trend after 2016 while the size of change seems higher than the analysis period as other variables. This decreasing trend

indicates that rents are also increasing with the rise in house prices. The rise in rents, due to the fact that landlords turn out to be tenant with the urban transformation, induces house purchases. Rising *pr* leads to higher share of rents in household budget further stimulating housing demand. Therefore, decrease in mortgage rates and *pr* may justify surges in house prices. It may be asserted that the housing prices in Turkey are mostly affected by cost factors rather than income.

7. Conclusion

Major economies experienced a steady and significant increase in house prices beginning from the early 2000s. Similarly, fluctuations in real estate market in US economy in 2007 were acknowledged as a significant contributor to global financial crisis since real estate markets, financial markets and the overall economy are tightly interconnected. In this respect, a number of research have focused on analyzing real estate markets and determining demand and supply side factors explaining fluctuations in these markets. Rising house prices in Turkey has also raised concern about whether this trend may be considered as a bubble. We, therefore, intend to analyze demand side factors of housing market and explanatory power of these factors on continuously increases house prices. In our paper we employ the Blanchard-Quah SVAR model in order to expose the long run relations among *gap*, *r_{mir}*, *ppr* and *pr*.

Our results indicate that increase in inflation rates accompanied by rising in real and nominal interest rates put a negative pressure on purchasing power of households who are heavily indebted. On the other hand, the surge in real estate sector in Turkey is expected to continue for the upcoming years. This trend, however, may not be accompanied by equivalent increase in rents. The surge in *pr* indicating long length of self-amortizing process is expected to fuel the incentive to be a landlord. The determinants of *gap* such as purchasing power parity and mortgage rates do not seem to have a robust explanatory power for gap analysis for the forecast of 24 quarters based on the data for 2005:Q4-2015:Q4. The results of the decomposition analysis are self-feeding until the 4th quarters. Thereafter, the importance of *gap* for explaining the change itself is replaced by other indicators in the longer terms. In this respect evaluating the demand factors used in this study, it may be asserted that housing prices in Turkey is unlikely identified as a bubble. However, since we only evaluate demand side factors of Turkish housing sector, it is also required to incorporate supply side factors into the housing market analysis for more extensive research in order to detect a bubble in Turkish real estate sector.

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