THE LINKAGE BETWEEN REAL ESTATE PRICES AND THE MACRO-ECONOMY IN CROATIA: VAR APPROACH

Ksenija Dumičić
Department of Statistics, Faculty of Economics and Business Zagreb
Trg J.F. Kennedy 6, HR-10000 Zagreb, Croatia
E-mail: kdumicic@efzg.hr

Anita Čeh Časni
Department of Statistics, Faculty of Economics and Business Zagreb
Trg J.F. Kennedy 6, HR-10000 Zagreb, Croatia
E-mail: aceh@efzg.hr

Petra Šprajaček
Faculty of Economics and Business Zagreb
Trg J.F. Kennedy 6, HR-10000 Zagreb, Croatia
E-mail: petra.sprajacek@yahoo.com

Abstract

The aim of this paper is to investigate the interrelation between the housing sector and macro-economy in Croatia. It focuses on the housing sector as a source of volatility and studies whether the changes in house prices easily spillover to the rest of the economy. Furthermore, it studies how domestic variables, especially financial conditions, influence house prices. Finally, as Croatia is a small open economy, the responses of housing prices and other domestic variables to external shocks were explored. For the purpose of our research, a five variable structural vector autoregressive (SVAR) model comprising both domestic and foreign variables was used imposing block-exogeneity restrictions and assuming that domestic shocks have no significant impact on foreign variable. The model suggests that the developments in house prices and other domestic variables were mainly caused by external shocks. However, the changes in real estate prices have important influence on domestic variables in Croatia.

Key words: *Real estate prices, Financial conditions index, External shocks, SVAR model, Block-exogeneity restrictions*

1. INTRODUCTION

The mid-2000s was a period of strong economic performance throughout the world, characterized mostly by low inflation and expansion of international trade, especially financial flows. This favorable equilibrium was accompanied by several trends, such as growth in real estate values in many advanced countries, including the world's largest economy, the United States. After a deep recession of 2007-2009 many scholars agreed that the burst of housing price bubble in the US was a main contributor to the financial crisis. Surprisingly, the crisis was initiated by the collapse of one other sector of the financial system, the secondary home mortgage market, that spillover to the rest of the economy (McDonald and Stokes, 2011). As the last few decades were characterized by low interest rates, many economists argued that the origin of the house price growth lies in too expansionary monetary policy (Taylor, 2007). According to the economic theory, low interest rates should increase asset prices. Therefore, the negative correlation between house prices and interest rates is not, by itself, the evidence that low interest rates cause bubbles on the housing market. However, it is not clear why house prices tend to overreact to interest rate reduction. Thus, it may be concluded that the changes on the housing market are not caused only by decision of the central banks, but they are closely connected with the fluctuations in both macroeconomic and financial variables.

According to economic theory, as house often accounts for a major share of household wealth, house prices may affect private consumption and investment via Tobin's q and so called wealth effect. Furthermore, there is a strong interdependence of real estate prices and the financial system. As a large share of financial sector assets is tied to housing values, house prices may affect both credit demand and credit supply. Moreover, bank lending may also affect property prices via liquidity effects. Such two-way causality between house prices and bank lending may leave banks' and households' balance sheets exposed to the changes in real estate values. Finally, a great attention is given to the shocks of monetary policy on the housing market. Monetary policy makers can directly affect the housing sector through interest rate (Goodhart and Hofmann, 2007; 2008).

Fully theoretical model integrating all potential interlinkages between house prices and the macro-economy does not exist, however in the last couple of years a number of studies arose on this subject (see for example Ándre et al., 2012; Bulligan, 2009; Carstensen et al., 2009; Demay, 2009). In that sense, there is a lot of empirical evidence showing the multidirectional link between house prices and the macro-economy. As a result, house prices may have a major effect on economic activity and the financial system. Therefore, the changes in the housing market may significantly amplify the effects of macroeconomic shocks, such as supply, demand or monetary shocks, and non-fundamental movements or bubbles in house prices may rise the imbalances in the economy (Goodhart and

Hofmann, 2007)**.** In contrast, macroeconomic variables have a significant effect on the housing market. The Croatian real estate market is very dynamic when it comes to prices.

The real estate market in Croatia has been growing more active thanks to both: demand and supply side. A relatively limited supply of residential real estate and increased availability of housing loans accompanied with lower interest rates are some of the factors that spurred the rise of real estate prices in Croatia over the last few years. The other reason might be a favorable macroeconomic environment before the recession that also contributed to the rise in house prices. There was a continued economic growth, low inflation and stable exchange rate over a year-long period supporting the optimistic outlook of households regarding their future income, as well as the rise in the standard of living and decrease in unemployment. At the end, there has been a rising interest of foreigners for the purchase of real estate in Croatia (especially on the Adriatic coast) and expectations of further growth of real estate prices, affected, among other things, by Croatia's rapprochement to the EU and the alignment of its legislation with European standards (Kunovac, et al., 2008).

To address the previously mentioned, using quarterly data, in this paper, three things are analyzed. Firstly, it studies how financial conditions in Croatia influence the developments in house prices. Secondly, it studies whether the changes in house prices easily spillover to the rest of the economy. Finally, as Croatia is a small open economy, the responses of the housing prices and other domestic variables to external shocks are explored. For the purpose of this research, a five variable structural vector autoregressive (SVAR) model comprising both domestic and foreign variables is used. As Croatia is a small open economy, foreign block-exogeneity restrictions are imposed, while it is assumed that domestic shocks have no significant impact on foreign variable. The latter is also concluded by Krznar and Kunovac (2010) who explore the spillover effects of external shocks on inflation and GDP in Croatia. They find that the external factors are the main determinants of domestic inflation and GDP. Moreover, domestic shocks have small effects on domestic variables. They also show the relevance of external shocks that must be taken into account in theoretical modeling of real domestic developments and fluctuations (see also CNB 2012).

To the best of our knowledge, this is the first attempt to investigate the interaction of the housing market and the rest of economy in Croatia, taking into account the impact of Euro area.

2. METHODOLOGY AND DATA

2.1. SVAR model

In the analysis the structural VAR model and assuming following specification is used (Enders, 2003):

$$AZ_t = A_0 + C(L)Z_{t-1} + \varepsilon_t \quad (1)$$

where Z_t is a vector of endogenous variables at time t, Z_{t-1} contains lagged endogenous variables, ε_t is a vector of structural innovations, A_0 is vector of constants, A is a matrix that contains structural coefficients and C(L) is a matrix polynomial in the lag operator L. However, the starting point of the SVAR analysis is the reduced form obtained by multiplying the SVAR model by A_0^{-1}, thus the reduced form of the VAR model is as follows:

$$Z_t = \mu + B(L)Z_{t-1} + e_t \quad (2)$$

where $\mu = A^{-1}A_0, B(L) = A^{-1}C(L)$ and $e_t = A^{-1}\varepsilon_t$. In this special case, the reduced form VAR model is estimated, where $Z_t = \left[GDP\_EU, FCI, GDP\_RH, CPI, HREPI\right]'$ is a vector of endogenous variables, which includes the real GDP for the Euro zone and Croatia (GDP_EU, GDP_RH), financial conditions index, the consumer price index (CPI) as a measure of the aggregate price level and the real hedonic real estate price index (HREPI).

However, the structural model cannot be directly estimated from reduced VAR form. The reason for this is that there is an infinite set of different values of matrix A and C(L) for given data, which makes it impossible to conclude, from the data itself, the correct values for these matrices (Gottschalk, 2001). In addition, to obtain the structural from reduced form, i.e. to achieve just identified system, certain restrictions should be imposed. Moreover, to identify the structural form $\frac{K(K-1)}{2}$ parameters restrictions should be imposed. One of the possible approaches to identification also used in this analysis is the Cholesky decomposition of white noise covariance matrix, $\Sigma_u = PP'$, where P is a lower-triangular matrix. Accordingly, a 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 the first variable, but only on other variables and so on. It can be seen that the order of endogenous variables in the VAR model is important, while choosing different ordering of the variables may produce different shocks (Lütkepohl and Krätzig ,2004).

2.2. Block-exogeneity restrictions

It is well known that the shocks in small open economies have very little impact on major foreign countries and therefore it is proper to treat the foreign variables as exogenous to domestic economic variables. As a result, the model is divided in two blocks: the Euro area and the Croatian block. To

describe the reduced VAR system (2) for a small open economy first, the set of variables Z_t is divided into two blocks as follows (Cushman and Zha, 1997; Zha, 1996):

$$Z_{1,t} = (GDP\_EU_t)$$

$$Z_{2,t} = (FCI_t, GDP\_RH_t, CPI_t, HREPI_t)$$

where $Z_{1,t}$ represents the foreign block and $Z_{2,t}$ represents the domestic block. The VAR model is given as follows:

$$Z_t = \begin{bmatrix} Z_{1,t} \\ Z_{2,t} \end{bmatrix} \quad B(L) = \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \quad e_t = \begin{bmatrix} e_{1,t} \\ e_{2,t} \end{bmatrix}$$

The two blocks, $B_{11}(L)$ and $B_{12}(L)$ contain the coefficients that correspond to the foreign economy, while $B_{21}(L)$ and $B_{22}(L)$ contain the coefficients that correspond to the domestic economy.

As Croatia is a small open economy, its shocks are unlikely to have a significant effect on the Euro zone economy and therefore restriction $B_{12}(L)=0$ is imposed. This is called the block-exogeneity restriction and implies that the first block $Z_{1,t}$ is exogenous to the second block $Z_{2,t}$. Furthermore, it should be noted that the matrix A is also composed of block-exogeneity restrictions, i.e. $A_{12}=0$. More precisely, it is assumed that the foreign variables are predetermined and the domestic variables do not Granger cause the foreign variables. A block-exogeneity is imposed by excluding all domestic variables from the foreign block of both contemporaneously and the lag structure of the reduced form VAR.

The reduced form of VAR model has been estimated by EGLS (estimated generalized least squares). For more details about the model estimation and structural analysis of the SVAR model with block-exogeneity restrictions, see Lütkepohl (2005).

2.3. Data

According to the previously mentioned literature, a slightly different approach in investigating the changes in house prices and their relationship with Croatian economy is undertaken. The main obstacle of this paper was to find a representative indicator of monetary policy. As noted before, low interest rates are considered as one of the main contributors of the growth in house prices. According to Lovrinčević and Vizek (2008) and Vizek (2010) the main determinants of house price volatility in Croatia are the interest rates on long-term household loans, household disposable income or GDP, loans to households and inflation. In many countries worldwide these variables are under a big

influence of nominal interest rates. However, in the case of Croatia, the Croatian National Bank has never used interest rate policy to achieve its objectives. It is well known that lending interest rate trends are separated from interest rates on money market in a short period of time. In order to control credit developments as well as to influence the conditions on money and foreign exchange markets, the CNB relied on various forms of reserve requirements, especially from 2003 till 2010 (see more in Ljubaj, 2012). As a result, using a money market rate in discussing the volatility of house prices would not be appropriate. Therefore, in the absence of benchmark interest rate and not finding an appropriate indicator of monetary policy stance, the monetary policy has not been taken directly into account. Instead, a financial conditions index is used.

The financial condition indices are extension of monetary condition indices which are computed to gauge the impact of monetary policy on the economy. The financial conditions index for Croatia is constructed by the CNB and takes into account the best indicators for financing availability, such as financial market conditions, the price of capital, collateral requirements and other lending conditions (see more in CNB, 2012). The financial conditions index is assumed to comprise the variables that are the main determinants of house price changes, so it is considered as an appropriate measure when explaining the developments on real estate market.

The Croatian real estate market is very dynamic when it comes to prices. According to the hedonic real estate price index in Croatia, in the period from 1st quarter of 1997 till 1st quarter of 2008, the prices of real estate went up by 104,11%. The strongest growth was marked in the period between 2004 and first quarter of 2008 when prices rose by 78,65 %. However, in the last couple of years, more precisely since the mid-2008, the real estate prices have started to fall and till the end of 2011 they decreased by 25,61%, which is shown in Figure 1.

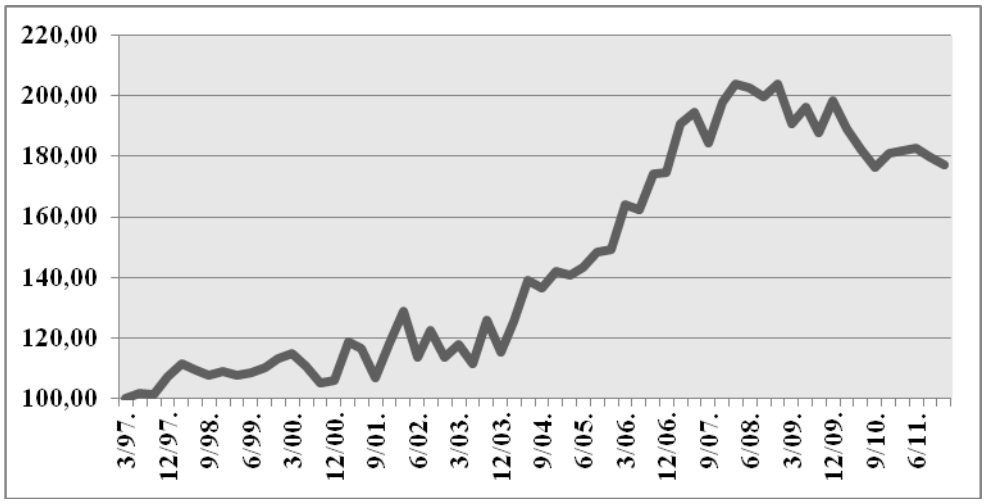

Figure 1: Hedonic Real Estate Price Index, 1st half of 1997=100

SVAR model used in this paper comprises both foreign and domestic variables for period between 2002Q1 – 2011Q4. Besides from the financial conditions index, the model also includes the following variables: the real GDP for Croatia and the Euro zone (GDP_RH, GDP_EU), the consumer price index (CPI) as a measure of the aggregate price level and the real hedonic real estate price index (HREPI). Considering the data sources, real GDP for Croatia and the Euro zone are taken from the Eurostat database, while all other variables are taken from the Croatian National Bank.

As introduced above, these domestic macroeconomic variables, i.e. GDP and the price level, are chosen because of their close relationships with house prices, theoretically and empirically. Furthermore, in a VAR model of a small open economy, as Croatia, the inclusion of foreign variables is essential for better and more precise specification as well as better understanding of the dynamic responses of domestic economy to domestic and foreign shocks (Cushman and Zha, 1997).

3. MODEL ESTIMATION RESULTS

In this section the SVAR model estimation results are discussed, i.e. the impulse responses and variance decomposition of selected variables. All data except financial conditions index are seasonally adjusted using the TRAMO/SEATS procedure. According to Augmented Dickey Fuller test at the 5% significance level, only the financial conditions index does not have unit root in levels, while all other variables are differenced in order to become stationary.

The most information criteria (AIC, HQ, FPE) suggested 4 lags, but in that case VAR model was not stable, so in order to achieve stability and satisfy other diagnostic tests, two lags, as suggested by Schwarz information criteria were used. Furthermore, the Portmanteau test is conducted to make a formal check that the selection of the number of lags does not contradict one of VAR model assumptions. The results of the Portmanteau test of autocorrelation of errors showed that there was no autocorrelation between errors, so the chosen number of lags was correct. The stability of the model is also tested by calculating the modulus of root. Since the root of the model is larger than 1 in modulus, the VAR model showed stable[1].

2.3. Innovation analysis

In order to analyze interlinkages between selected variables, accumulated impulse response functions are used. In the case of foreign shock the growth of foreign GDP is the main driver of the dynamics of domestic variables which is in line with literature about small open economies and previous empirical

[1] The unit root test, the modulus of the root calculation, the Portmanteau test and lag number tests are available from authors upon request.

findings. The growth of foreign GDP decreases the financial conditions index, thus representing the financial loosening. However, these effects are significant in the first seven analyzed quarters. As expected, domestic GDP and HREPI increase significantly. Finally, impulse response function shows alternating effects on the price level, but the effect is only significant for responses between 7 to 10 quarters after a shock.

The growth of house prices has positive effects on GDP and CPI, while it has negative on the FCI. However, it must be pointed out that in case of GDP the shock becomes significant after a year, while in case of CPI these effects are significant in the first five quarters. These results are also in line with economic theory and empirical findings. The impact on domestic variables shows that the fluctuations on housing market spillover to the overall economy. The positive impact on the price level can be explained as follows: the increase in house prices leads to a higher wealth of households which translates into a higher demand for goods and services leading to inflationary pressures. As house prices increase, more collateral is available to secure mortgage, thus explaining the financial loosening as a response to house price shock. More precisely, when real estate prices are rising, the value of collateral is increased and banks have the possibility to give more credit to households. Thus, an increase in real estate prices raises credit supply and lowers interest rates.

The inflationary shock on GDP and FCI is positive, but only significant in the first year after a shock. On the other hand, it declines significantly the house prices. According to economic theory, real estate prices are expected to rise due to inflation, while economic agents try to protect their wealth by investing in real estate assuming that the real estate is a good hedge against inflation. However, the rise in interest rates is expected, thus causing the house prices to fall. Indeed, the financial conditions are also tightened in the short run, explaining the drop in the real estate prices.

Furthermore, the results of the FCI shock are also expected. When FCI declines all domestic variables increase significantly. By financial loosening interest rates are getting lower, giving the possibility to grant more credit. By rising credit supply, the house prices also rise. Moreover, the rise in real estate prices is also determined by other favorable financing terms and conditions.

Next, the shock of domestic GDP is discussed. There is a positive impact on FCI and negative on CPI. However, the effect on CPI is never significant. Finally, GDP increases real estate prices significantly. This result confirms a positive relationship between these two variables as pointed out in economic theory. The output stimulus leads to an increasing demand for real estate. More people are at work, thus they become wealthier. Their personal income is increased as well as their consumption resulting the rise in real estate prices.

Finally, the variance decomposition of the variables in the system is discussed. Not surprisingly, the variances of the most variables are predominantly due to external shock. However, only hedonic real estate price index is mostly explained by its own shock. At a horizon 4 foreign GDP shock accounts for about 62% of the variation in financial conditions index, 30% of the fluctuations in Croatia's GDP, 34% of the price level variations and 21% variation of the real estate prices. The dominating influence of conditions in the Euro zone on domestic variables, once again confirms strong spillovers of economic shocks from the Euro zone to Croatia. As mentioned above, domestic FCI and GDP shocks influence each other; however the FCI has a stronger contribution to the variation of GDP, but not vice versa. Real estate prices explain around 5% of all fluctuations in the GDP and 7% of CPI. This is in contrast to other European countries, where the fluctuations in housing prices have greater influence on GDP and inflation. It is very interesting that the impact of real estate prices in explaining the changes in the FCI increases and at horizon 8 accounts for about 10% of the variation. Such results show that developments on the housing market have important impact on the rest of the Croatian economy. Moreover, it was expected that the FCI would have greater influence on real estate price, but the foreign and domestic GDP are shown to be the main drivers in the fluctuations of house price.

4. CONCLUSION

In this paper the relative importance of domestic and external shocks for the movements and volatility of real estate prices, as well as the importance of housing cycles for economic activity were analyzed. In comparison to the existing literature, a different approach in studying the comovements between housing prices and the wider economy is taken. Accordingly, foreign variable was used and direct role of monetary policy was excluded from the model. Moreover, instead of including nominal interest rate, the financial conditions index was chosen. Namely, there is a weak interest rate channel of monetary policy and the lack of any market influence on bank loans and prices via interest rate. Thus, using a nominal interest rate as an indicator of monetary policy would be unreliable. Furthermore, it is assumed that the developments of house prices are mostly connected with loosened terms and conditions when granting loans, lower interest rates on housing loans that have stimulated the credit growth and the favorable macroeconomic surrounding. These variables are included in the financial conditions index and also exchange rate, that is used as a monetary policy instrument by the CNB to achieve its primary objectives. Finally, as Croatia is a small open economy, the inclusion of foreign variables is important in order to obtain a better specification of the dynamic responses of domestic economy to domestic and foreign shocks.

Against this backdrop, the structural vector autoregressive (SVAR) model with block-exogeneity restrictions was implemented for the period between the first quarter of 2002 and the last quarter of 2011. Impulse response functions and variance decomposition provide economically meaningful results. As expected, the foreign GDP is found to be the main contributor of overall volatilities in domestic variables. Furthermore, it is shown that the developments in real estate price have significant impact on domestic variables, but mostly on the financial conditions in Croatia. The important interdependence between financial stability and the housing market is found. The changes in real estate prices may lead to adverse effects in the balance sheets of banks which granted housing loans taking the real estate as collateral. Thus, the fall in those prices may produce turbulences in banks. It should also be noted that the bank exposure to the risks of change in real estate prices and other possible disturbances on the real estate market, rise with an increase in the share of housing loans in total loans to households.

In this paper an empirical support that external shock is a key element of the interplay between domestic variables was found, but also, so called real estate channel becomes more important factor which can affect the processes in some particular segments of the real economy.

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