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Analysis of Factors Affecting the Dynamics of Residential Real Estate Prices in Russia

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ABSTRACT

In this paper, we have constructed a VAR model to identify and assess the impact of real interest rate shocks, real estate demand, oil prices, uncertainty, and aggregate business activity on residential real estate prices in Russia. The relevance of the research is due to the following: the dynamics of real estate prices determines the consumer and investment behavior of households, and serious fluctuations in real estate prices lead to adverse consequences in many areas of life, so more and more researchers are asking questions about the presence of bubbles in the real estate market, which can be dangerous to the stability of the economy. In addition, a sharp increase in the cost of housing in Russia in 2020 is an open question for researchers. Our **goal** is to determine what factors caused the rise in real estate prices in Russia in the time interval from the Q1 of 2000 to the Q2 of 2022. A VAR model with a Cholesky decomposition was used for the **evaluation**. Several specifications were considered with the inclusion of the real oil price as an exogenous variable and a set of endogenous variables: real GDP, real interest rate, uncertainty index and housing price index. The main **conclusion** of the paper is that the housing market is sensitive to identified macroeconomic shocks, and a decrease in the interest rate leads to an increase in demand and real estate prices. The estimate of the long-term elasticity of housing prices for oil prices was 0.35, the dynamics of oil prices explained a significant proportion of the variation in real estate prices, but the predominant role in housing price fluctuations is given to housing demand shocks. The housing demand shocks in Russia itself had a negligible impact on GDP.

Keywords: real estate price index; housing market; VAR models; macroeconomic shocks; real interest rate shock; historical decomposition of the real estate price index; real estate demand shock; oil price shock

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INTRODUCTION

Housing prices increased significantly in 2020 (Fig. 1). “The cost of residential real estate increased by 12% on average in Russia, but in some regions, prices have risen by 20 and 30%”.¹

Overall, housing price fluctuations can have huge macroeconomic effects. This is what the global economic crisis of 2008 showed when the real estate market was one of the most important channels of influence of traditional structural shocks on dynamics of macroeconomic variables. In addition, the real estate market is a significant independent source of macroeconomic instability. Events are stimulated the growth of housing market research.

In this paper the standard vector autoregression model (VAR) is used, and for the identification of shocks — Cholesky decomposition. We identified the real interest rate shock, uncertainty, aggregate supply and demand for housing, and the oil price shock as an important source of macroeconomic instability in Russia’s real estate market.

The paper is structured as follows: second section provides an overview of the literature, third section — presents a description of the data, fourth section — presents empirical models and results of calculations, and fifth section — presents conclusions.

REVIEW OF THE LITERATURE

Interest rates are rightly the most important determinants of real estate prices in asset pricing, as well as the factor affecting on credit availability. The real estate price, other things being equal, can be considered as the present value of future rent payments. Then, if the real interest rate is lowered, the present value of these rent payments increases. If we abstract from depreciation and maintenance costs of real estate, then when interest rates are reduced, the real estate price should rise.

In addition, the expected present value of future rent payments should be equal to the profitability of alternative investments with a comparable level of risk, according to J.M. Poterba [1].

A number of works are devoted to the analysis of the contribution of real interest rates to real estate prices. S. Claessens with co-authors [2] proved pro-cyclical behavior of housing prices, and low interest rates precede the peaks of real estate prices with a few years left, that was explained in the paper of A.G. Ahearne with co-authors [3]. D. Miles and V. Monro [4] explain the rise in housing prices relative to income in the UK by a significant reduction in the real risk-free interest rate. Similar research was conducted by J. Ayuso with co-authors [5]. Using simple asset price ratios, changes in housing prices can be fully explained by changes in ex-post real interest rates. At the same time, the paper of K.N. Kuttner [6] also examines the relationship between interest rates and housing prices, but argues that the impact of interest rates on real estate prices is rather modest.

In the paper of M. Iacoviello [7] positive shock of aggregate supply statistically significantly reduces housing prices for several quarters: shock increases the return on capital, which leads to an increase in real interest rates. Then M. Iacoviello and S. Neri [8] are questioned: what sources of macroeconomic instability affect the US real estate market? Researchers identify three shocks: real estate demand shock, monetary policy (MP) and technological shock. The MP shock has a negative impact on prices, as confirmed by earlier researches of the same authors and K. Carstensen with co-authors [8–10]. In the paper of T.Y. Bian and P. Gete [11] use a similar methodology. Labor productivity shocks and savings glut play a major role in housing prices.

Evaluation of the housing market’s response to the MP shock was done for K. Carstensen [10]. Authors find out that

¹ Materials of the information agency “RBC”. URL: <https://www.rbc.ru/society/08/04/2021/606efdb09a79472934b87a8b> (accessed on 12.08.2021).

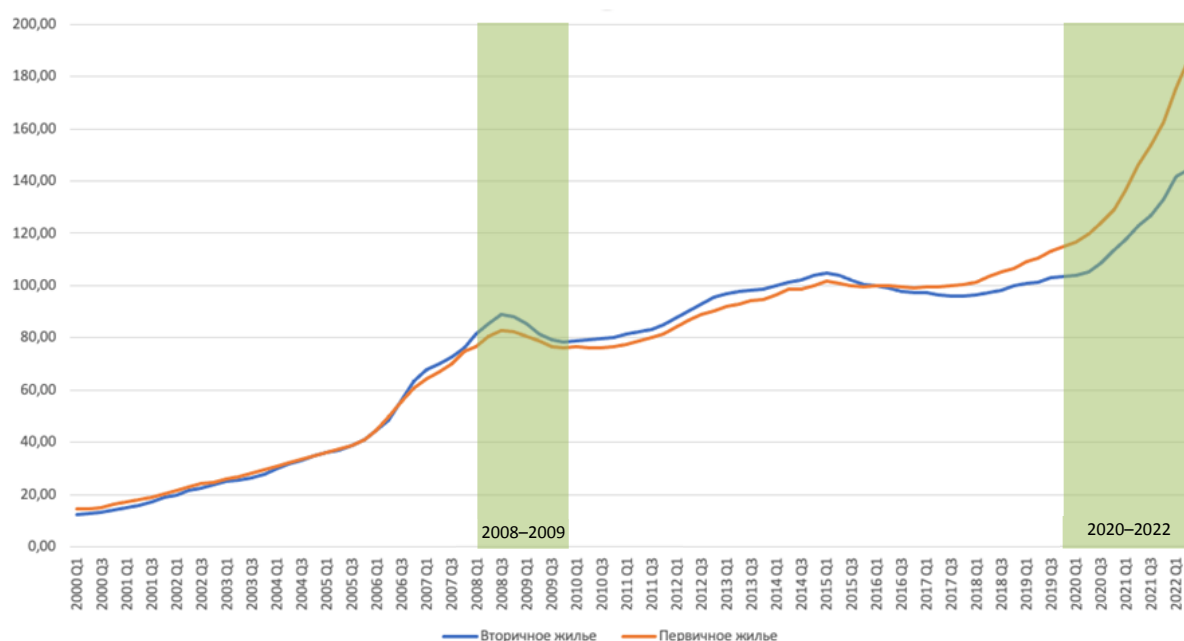


Fig. 1. The Index of Real Estate Prices in Russia in Constant Prices of the Q1 of 2016

Source: Unified interdepartmental information and statistical system. URL: <https://www.fedstat.ru/indicator/30925> (accessed on 19.10.2022).

countries can be divided into 2 clusters relative to the degree of response to shock: countries with strong response and weak. The reaction is due to the institutional characteristics of the mortgage market. Result intersects with conclusions from article M. Iacoviello [7]. A. Nocera and M. Roma [13] considered the role of housing prices in the transmission mechanism of monetary policy: due to the high housing prices growing wealth of homeowners, which is seen as the sum of liquid financial assets.

The market reaction of housing on oil shocks differs depending on whether the country is an oil exporter or oil importer [14–16]. As for the Russian practice, the work of V.A. Salnikov and O.M. Mikheeva [17] presents a model of pricing on the real estate market of Moscow. Based on the LSM model, a significant positive impact of Urals crude prices in the housing price dynamics was found.

H. Hirata and co-authors [18] use the FAVAR model to prove the existence of synchronized housing price dynamics in 18 European countries. The R. Meeks methodology was used to highlight the specific shock of the

credit market [19]. In the paper of G. Baurle and R. Scheufele [20] was estimated the impact of credit market conditions on housing prices and main macroeconomic indicators: monetary policy and housing demand shocks has a positive effect on real economic activity after the financial crisis.

Economic uncertainty directly affects the behavior of economic agents, because of precautionary motive households increase saving [21]. If interpreted the sale of residential real estate as savings, the increase in uncertainty in the economy can lead to an increase in demand for real estate and, accordingly, its prices [22, 23]. The mortgage market in Russia is lagging behind the developed countries: interest rates are significantly higher [24]. Housing affordability in Russia was analyzed in article N. B. Kosareva and T. D. Polidi [25], which note the increase in housing affordability in large urban areas. The effectiveness of State support measures for mortgage lending for housing affordability in Russia was studied in the paper of N. Ilyunkina and I. Roshchina [26]. The authors calculated that the subsidy

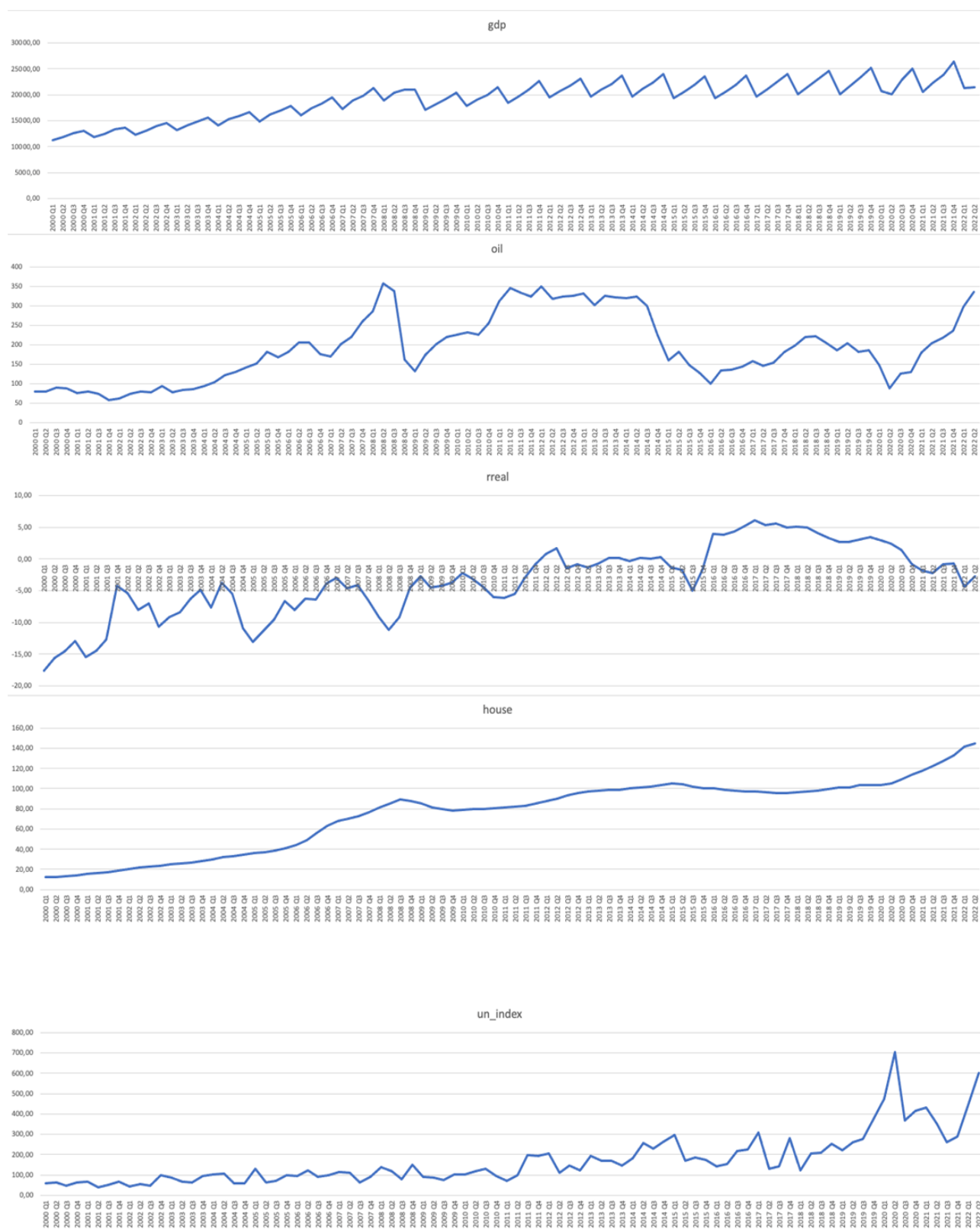


Fig. 2. Dynamics of the Variables

Source: Federal State Statistics Service, The Central Bank of the Russian Federation, Unified interdepartmental information and statistical system, Federal Reserve Economic Data (accessed on 19.10.2022).

Table

Selection the Number of Lags Based on the Values of Information Criteria

Number of lags	Information criteria		
	AIC	BIC	HQC
1	-1.68	-1.43	-1.58
2	-1.94*	-1.57*	-1.79*
3	-1.90	-1.40	-1.70

Source: Author's calculations.

Note: * Lowest value of each criterion.

of the mortgage rate of 3.5 p.p. leads to an increase in real estate prices by 10.5%.

DESCRIPTION OF DATA

Quarterly data from the Q1 of 2000 to the Q2 2022 were used for calculations. Several specifications are considered including the real price of oil (*oil*) as an exogenous variable and three or two endogenous variables: real GDP (*gdp*), real interest rate (*rreal*), housing price index (*house*) and uncertainty index (*un_index*) (justification for the choice of a specific indicator will be provided later). All models give results for secondary housing price index. The results for the primary housing price index are almost identical and can be provided separately on request. The real variables are expressed in 2016 prices and if cleared of seasonality by the X-13 ARIMA procedure in Gretl. Fig. 2 shows the dynamics of the variables used.

Price index on the housing market taken as a whole in Russia for all types of apartments. It should be clarified that the index is calculated on the basis of recorded prices and is determined by the ratio of the value of a certain type of sold apartments in the prices of the reporting period to the value of apartments in the prices of the previous period. This should be taken into account as there is a difference between the actual transaction price and the offer price.² We

used the MIACR rate minus inflation as the real interest rate. Data in the form of “quarter to the corresponding quarter of the previous year” was used as an inflation indicator. This approach allows to get seasonally differentiated rows, and therefore, there is no need to clean the received rows from seasonality in addition.

EMPIRICAL MODELS AND RESULTS OF CALCULATION

Consider the simplest VAR model including the real interest rate and the real estate price index as endogenous variables. We include Brent price as exogenous variable. We can assume that in Russia domestic macroeconomic indicators do not influence the dynamics of our exogenous variable, but it can significantly influence on our dataset of endogenous variables. The model is presented as follows:

$$y_t = \sum_{i=1}^2 A_i y_{t-i} + \sum_{i=0}^2 B_i oil_{t-i} + a_1 d_t + u_t,$$

where y_t — vector of endogenous model variables; A_i — matrix before the lags of endogenous variables; B_i — matrix before exogenous variables; oil_t — oil price vector; d_t — binary variable to structural shift; u_t — error vector. Real estate and oil price index variables used in logarithmic differences, real interest rate — in logarithmic levels. As in the paper D.A. Lomonosov with co-authors [27],

² Sberindex. URL: <https://sberindex.ru/ru?partition=7> (accessed on 24.09.2021).

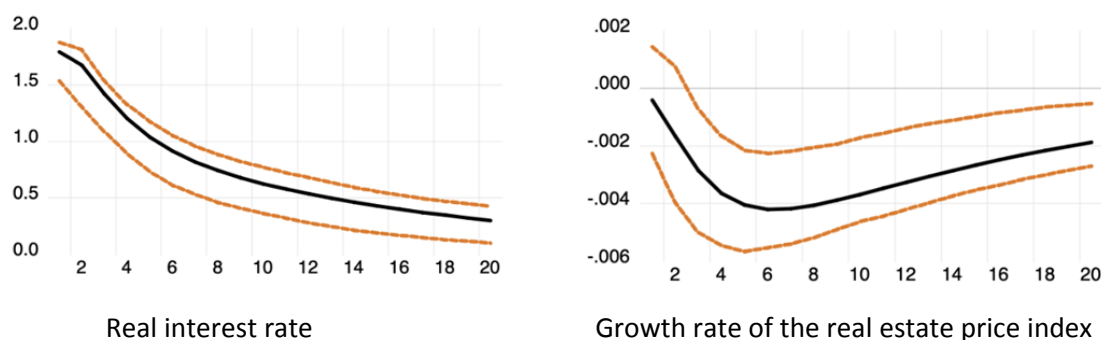


Fig. 3. Impulse Responses to the Real Interest Rate Shock

Source: Author's calculations.

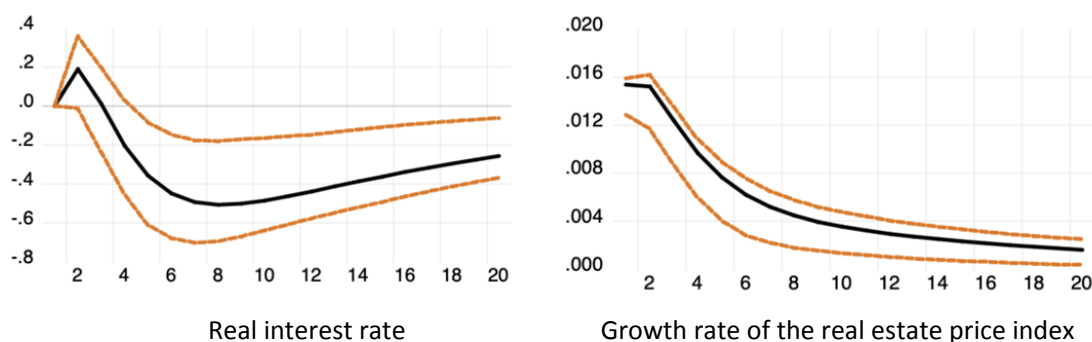


Fig. 4. Impulse Responses to Housing Demand Shock

Source: Author's calculations

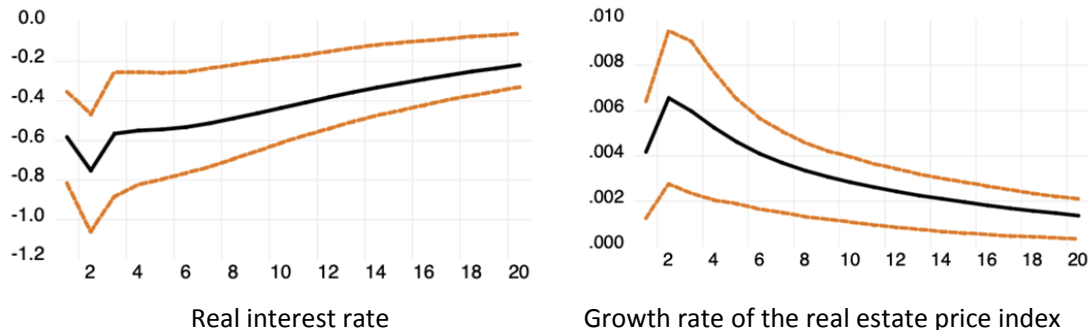


Fig. 5. Impulse Responses to the Oil Price Shock

Source: Author's calculations.

we take into account the structural shift in long-term growth rates during the crisis 2008. To estimate the date of the shift, we take Q3 of 2007, as well as in the paper of A.V. Polbin and A.A. Skrobotov [28].

When evaluating the model, we apply two lags of endogenous variables as well as two lags of exogenous variables together with the current value. Information criteria for choosing the optimal lag order are presented in Table.

To identify structural shocks, this model uses the classic Cholesky decomposition, in which we can order the effects of shocks by exogeneity. Order of variables: oil price, real interest rate and real estate price index. Figure 3–5 presents the impulse responses of real estate prices and real interest rates to the corresponding shocks with 68% confidence intervals derived from the bootstrap.

Real estate price index declines in response to real interest rate positive shock. The

reaction rate of real estate price index growth is significant for the whole time period under consideration and fades 1.5 years after the shock, reaching the bottom by the Q5. This sensitivity of the housing market to interest rates can be interpreted as follows: as households are limited in borrowing — the amount of credit available, the increased availability of credit due to lower interest rates will lead to higher housing prices due to increased demand. During the positive shock of real interest rates, the situation is reversed. Also, the growth (decrease) of the interest rate will lead to a decrease (increase) of the present value of rent payments and, accordingly, to negative (positive) pressure on real estate prices.

Fig. 5 presents the impulse response to the oil price shock. In response to the positive shock of oil prices, the real estate price index is rising significantly and peaking in the Q1–Q3, the impact of the shock is significantly fading after 20 quarters. This effect of the shock is consistent with the literature review and confirms the sensitivity of the housing market to the oil products market.

To calculate real estate price multiplier for oil prices, we need accumulated impulse responses to the price index growth rate of the oil price shock (Fig. 6).

Based on the calculations — if the oil price increases by 17%, corresponding to

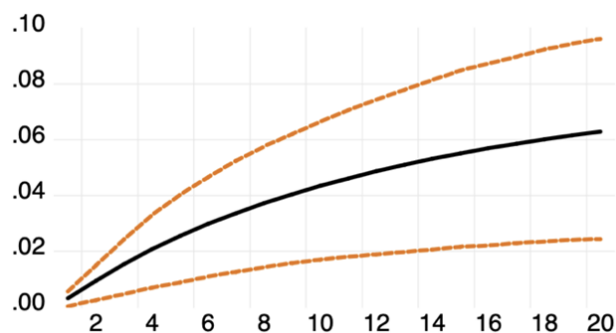


Fig. 6. Accumulated Impulse Response of the Real Estate Price Index to the Oil Price Shock

Source: Author's calculations.

one standard deviation, the real estate value increases by 6%, i.e. the elasticity of real estate prices is 0.35. When comparing with the elasticities of other indicators, real estate price elasticity at oil prices is slightly higher than the same indicator for consumption and investment — 0.3 and 0.25 respectively [29].

Next, consider the forecast error variance decomposition (FEVD). Results are shown in Fig. 7. The oil price shock explains 5 to 18% of the variance of the forecast error for the real estate price index, while the share explained by the shock of the real interest rate is gradually rising from 0 to 8%, the contribution of real interest rate shocks — is limited.

Real estate prices, as can be expected, in historical retrospect were highly susceptible

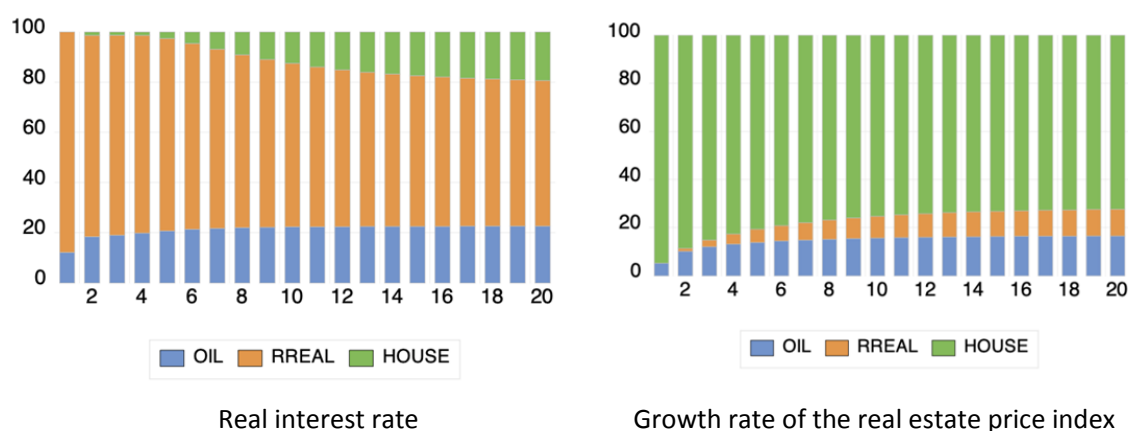


Fig. 7. Forecast Error Variance Decomposition

Source: Author's calculations.

Note: The vertical line is the percentage of the explained variance; the horizontal line is the quarters.

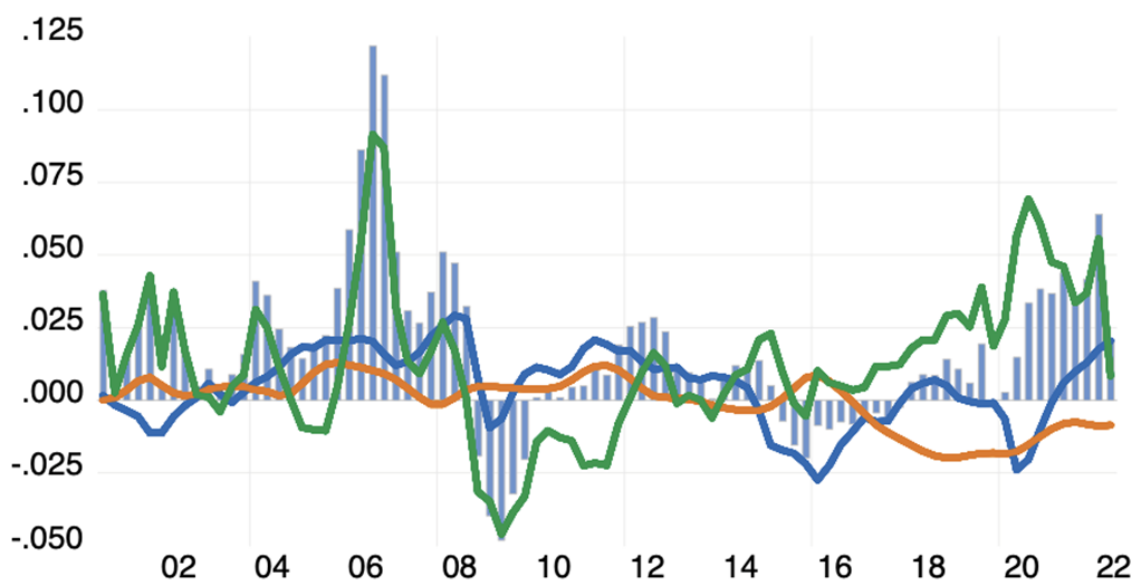


Fig. 8. Historical Decomposition of the Real Estate Price Index

Source: Author's calculations.

Note: Blue vertical columns is the deviation of the true value of the time series from its unconditional average; blue line – oil price shock; green line – housing demand shock; orange line – real interest rate shock.

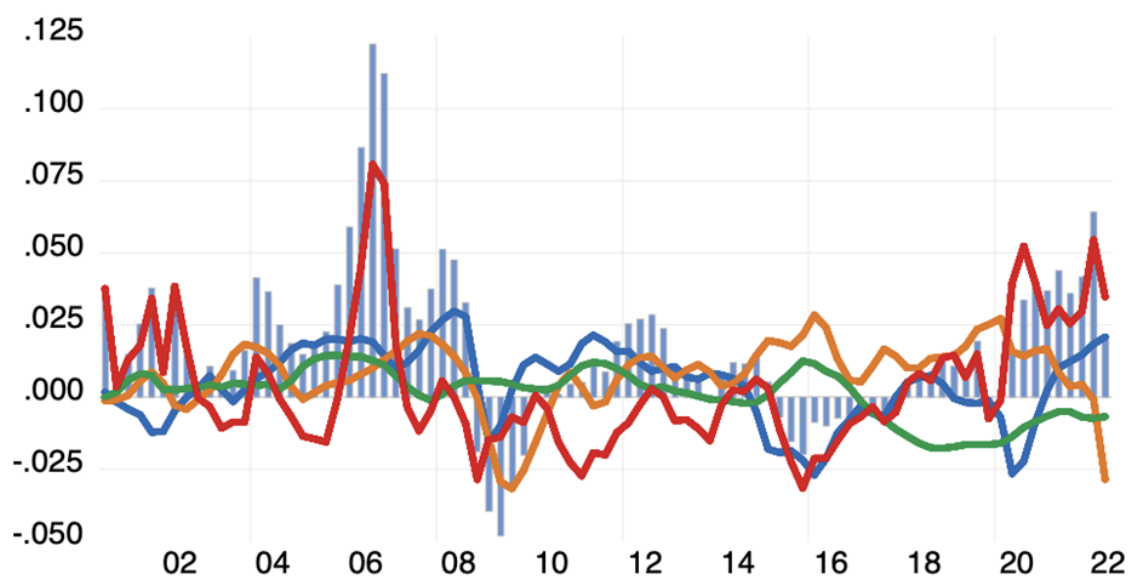


Fig. 9. Historical Decomposition of the Real Estate Price Index

Source: Author's calculations.

Note: Blue vertical columns is the deviation of the true value of the time series from its unconditional average; blue line – oil price shock; orange line – aggregate supply shock; green line – real interest rate shock; red line – housing demand shock.

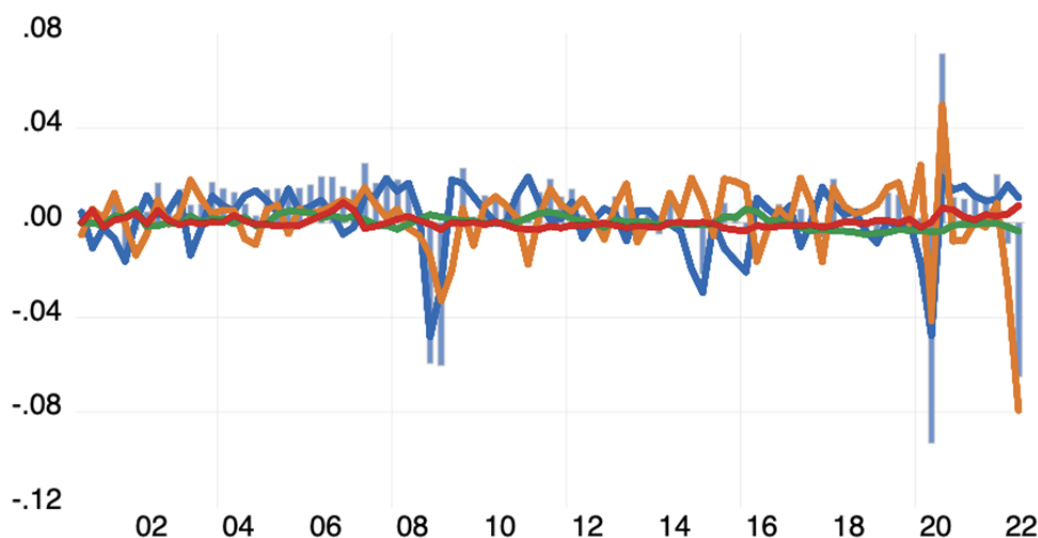


Fig. 10. Historical Decomposition of GDP

Source: Author's calculations.

Note: Blue vertical columns is the deviation of the true value of the time series from its unconditional average; blue line – oil price shock; orange line – aggregate supply shock; green line – real interest rate shock; red line – housing demand shock.

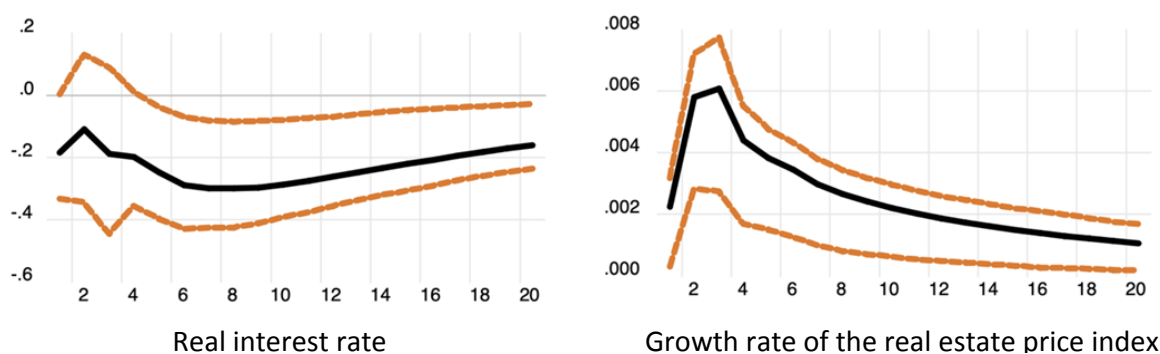


Fig. 11. Impulse Responses to the Uncertainty Shock

Source: Author's calculations.

to oil price shocks almost all the considered time interval (Fig. 8).

The situation changed in 2017–2019: oil prices stabilized and ceased to have an impact on real estate prices. By itself, the shock of the real interest rate affects only insignificantly on the dynamics of the indicator of interest. However, it should be noted that this shock has a mildly positive impact before the crisis of 2014–2015, but with the onset of the crisis after the increase in interest rates by the Bank of Russia its impact is already on the negative, reaching the bottom in the Q2 of 2018. In the pre-crisis period 2006–2007, the growth of well-being of the

population and the development of the financial market led to increased demand in the mortgage market due to increased availability of credit, and, accordingly, to the growth of demand in the real estate market. Sharp increase in prices for real estate in 2020 is explained by the real estate demand shock. The increase in demand could be due to the increased demand for meters as part of the development of remote work, due to the precautionary motive in which households faced with great uncertainty in the development of the financial market, in the inflation trend, decided to protect savings by investing in real estate, due to the

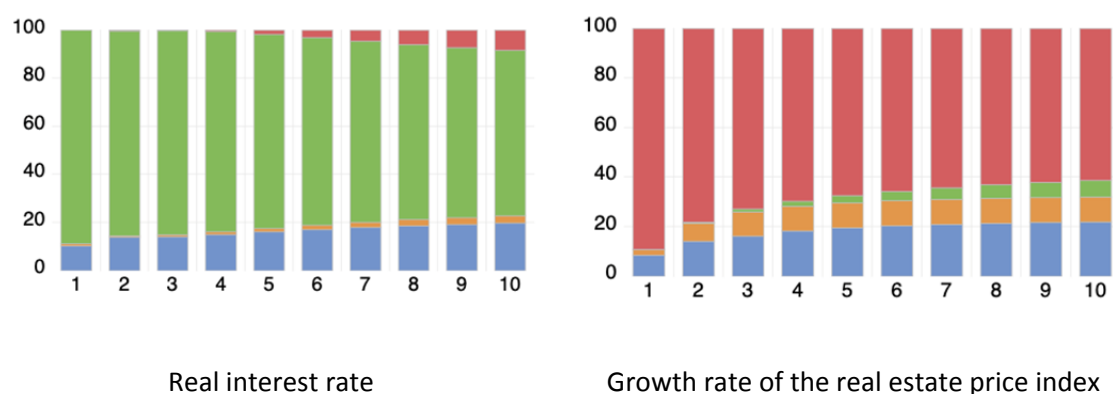


Fig. 12. Forecast Error Variance Decomposition

Source: Author's calculations.

Note: The vertical line is the percentage of the explained variance; the horizontal line is the quarters. Colors: red – housing demand shock; green – real interest rate shock; orange – uncertainty shock; blue – oil price shock.

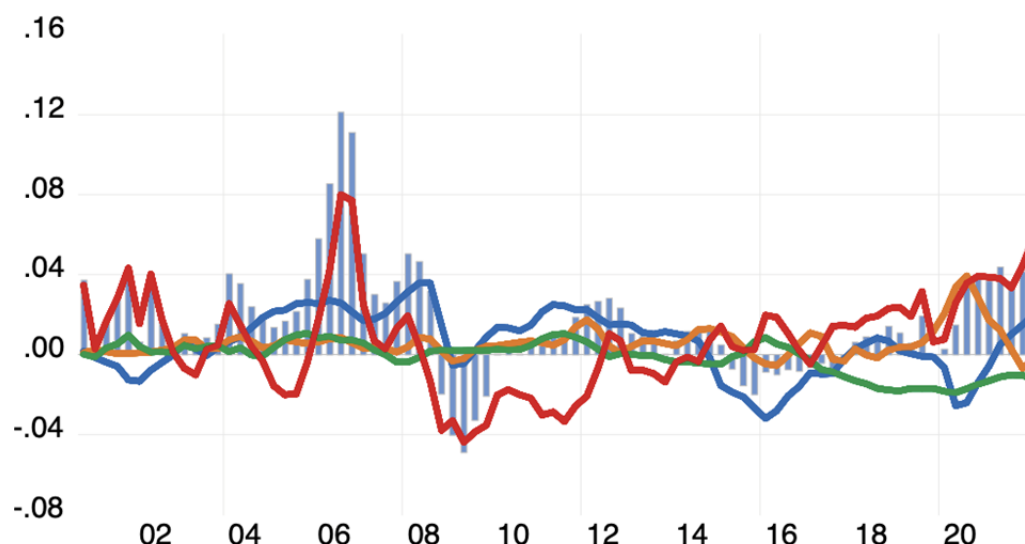


Fig. 13. Historical Decomposition of the Real Estate Price Index

Source: Author's calculations.

Note: Blue vertical columns is the deviation of the true value of the time series from its unconditional average; blue line – oil price shock; green line – real interest rate shock; orange line – uncertainty shock; red line – housing demand shock.

expansion of preferential mortgage. At the same time, loose monetary policy, along with relatively high inflation, allowed to reduce the previous negative contribution of shocks of the real interest rate to zero. The rise in prices between 2020–2022 was mainly due to the oil price shock, which had an increasing impact. At the same time, the shock of

housing demand and the shock of the real interest rate contributed to the “cooling” of the real estate market. Multidirectional movement of factors did not help stabilize and balance the price growth.

In the second specification we add real GDP as a significant income factor to the vector of endogenous variables.

Historical decomposition of the real estate price index is presented in *Fig. 9*, and for GDP — in *Fig. 10*.

Fig. 10 shows that in Russia the housing demand shock (red line) has no significant impact on the dynamics of GDP except for the first three quarters of 2007, before the global economic crisis of 2008, and the first quarters of 2020.

We use the Economic Policy Uncertainty Index for Russia as an uncertainty index. This index consists of three components: the first component — is the normalized volume index of news articles discussing economic policy uncertainty; the second component — the level of uncertainty regarding the Tax Code; the third component — variance between individual expert forecasts (in more detail³). Other uncertainty indices (World Uncertainty Index, Geopolitical Risk Index, CBOE Volatility Index: VIX) did not show significant results in the modelling process, so it was decided to focus on the first — Economic Policy Uncertainty Index (*un_index*).

Fig. 11 presents impulse responses to real estate prices and real interest rates for uncertainty shocks.

In response to the positive shock of uncertainty, the real estate price index rises significantly and peaks in Q3.

Results of error variance forecast decomposition (*Fig. 12*) show that uncertainty shock explains up to 10% variance.

On a graph with historical decomposition (*Fig. 13*) the shock of uncertainty describes a significant increase in the real estate price index since 2020. So, due to the increasing uncertainty due to the epidemiological crisis,

economic agents have significantly increased their savings due to the precautionary motive that was sent for the purchase of residential real estate, which can be classified as one of the safe assets (especially in comparison with stocks), which, with a low elastic supply in the housing market, led to a serious rise in prices.

CONCLUSION

In this paper, we have identified and assessed the impact of housing demand shocks, oil prices and aggregate business activity on residential real estate prices in Russia. For this, the standard vector autoregression model (VAR) was used, and the Cholesky decomposition was used to identify shocks.

Based on the impulse functions of the response, a significant impact of the shocks we identified was found both in the short and long term. This behavior of the real estate market is explained by the sensitivity of the market to shocks of this type. Also, the results of the historical decomposition confirm the importance of the variables chosen by us. The sharp rise in real estate prices in 2020 is due to a real estate demand shock. Expansion of demand could be due to increased demand on meters as part of remote work development or due to precautionary motive. The long-term elasticity of housing prices at oil prices was estimated at 0.35, which is reasonable, as the resulting elasticity is slightly higher than for consumption and investment.

One of the limitations of this paper is the lack of consideration of the date of introduction of the program of preferential mortgage in Russia. Other econometric approaches to assessment should be used to identify causal relationships of the effects of this measure.

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³ URL: <https://www.policyuncertainty.com/methodology.html> (accessed on 19.10.2022).

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