

*Milena Radonjić**
*Vladimir Đurišić***
*Sunčica Rogić****
*Andrija Đurović*****

JEL Classification C50, E00, R30
Prethodno priopćenje
<https://doi.org/10.32910/ep.70.4.2>

THE IMPACT OF MACROECONOMIC FACTORS ON REAL ESTATE PRICES: EVIDENCE FROM MONTENEGRO

The real estate market, as one of the most volatile economic sectors, is a key research topic for many authors. Regardless the significance of this topic, no previous research has been conducted to evaluate the factors which influence the price of real estate in Montenegro. Therefore, the objective of this study is to clarify whether the trend in real estate prices in Montenegro can be explained by macroeconomic fundamentals such as GDP, the inflation rate, interest rates on mortgages, take-up of mortgages, the unemployment rate, the average net salary, the current account deficit and constructing activity and to determine which of them is the most important in explaining the price trend for this market. The applied methodology is based on the model averaging technique, which has not been used in previous research on this topic; it enables the research to focus on the relevant results despite the short time series and the large number of independent variables. The results obtained point to the fact that price trends in real estate are best described by and

* M. Radonjić, teaching assistant, Faculty of Economics, University of Montenegro (e-mail: milena.radonjic@live.com)

** V. Đurišić, teaching assistant, Faculty of Economics, University of Montenegro (e-mail: vladodjurisic@yahoo.com)

*** S. Rogić, teaching assistant, Faculty of Economics, University of Montenegro (e-mail: suncica.rogic@hotmail.com)

**** A. Đurović, risk advisory manager, Deloitte, (e-mail: djandrija@gmail.com)

Rad je primljen u uredništvo 21.06.2018. godine, a prihvaćen je za objavu 26.10.2018. godine.

most closely align to GDP. Apart from GDP, net salary, the unemployment rate as well as the take-up of mortgages and their interest rates are shown to be significant as variables, which determine price trends within the real estate market.

Keywords: determinants of real estate prices, macroeconomic factors, real estate market, model averaging technique

Introduction

Immediately upon regaining independence in 2006, an above average increase in economic growth was achieved in Montenegro. In such an economic environment, which implied establishing macroeconomic stability, the growth of living standards, the development of the banking sector, the development of the capital market, as well as establishing ownership relations, there has also been a significant increase in real estate prices. That trend of price increase was caused by growth in the demand for real estate, both from domestic (generated as a consequence of the effects of increased purchasing power – the increase in employment and earnings), and foreign (especially Russian and British) buyers. Montenegro found itself in the middle of a real estate boom, which led to the fact that the average price of real estate in 2008 was EUR 1530 per square meter, which exceeded prices in Berlin or Beijing. After that, with the overflow of the global financial crisis to the Montenegrin economy, there has been a weakening, caused by the stagnation of those factors which used to be the triggers of the growth in real estate prices; as such prices were corrected downwards so that the average real estate price in 2016 was EUR 1011 per m².

Since the real estate market represents one of the most volatile sectors in the economy, the connection between real estate prices and macroeconomic variables have received significant attention from both researchers and policy creators over recent decades. For economists who believe that the economy can be easily managed through government policies, the real estate market represents a significant lever in that management process. Although there are a lot of studies which have dealt with this topic, none of them have explored the example of Montenegro. The real estate market in Montenegro is quite unpredictable, and the length of the time series on the trends in this market is very limited. Because of that, the objective of this study is to determine the most significant macroeconomic variables which influence real estate prices and to determine the degree of their influence. Thus, this analysis will clarify whether the price trend can be explained by macroeconomic fundamentals. As there are a great number of studies that have been carried

out in transition countries, we can determine the ways in which the results for this country are similar or different from those of countries with similar development levels. On the other hand, the econometric techniques which examine the real estate determinants can be classified into the following groups: vector autoregressive models (VAR models) and error correction models (ECM) approaches, panel regression and simple and multiple linear regression. This study will apply a methodology based on the model averaging technique which, to the best of our knowledge, has not been used in previous studies which examined this topic in other countries, and which therefore also represents a contribution of this study.

In previous research, apart from GDP, the influence of which is undoubted, one significant element which influences the trend of demand for real estate is the trend in interest rates on approved mortgages. Thus, the interest rate and availability of mortgages are two of independent variables which are used in this research. On the other hand, as Montenegro is a small and open market economy, the current account deficit was taken into consideration, as well as foreign direct investment (FDI), considering the fact that they are one of the ways of financing that deficit. If we monitor the structure of FDI inflow according to investment type, the biggest share is related to real estate purchase, which clearly points to vulnerability in financing the current account deficit, due to changes in the external environment and the possibility of the withdrawal of the funds. Although the stock price has proven to be a significant factor which influences real estate prices in previous studies, due to the underdevelopment of the Montenegrin securities market, this variable was not analyzed in our study.

The study comprises of four parts. The first part provides an overview of the results of empirical studies which examined real estate price determinants. After that, the second part describes the data and defines the variables which will be included in the model. The third part describes the methodology that was used for data modeling, and subsequently moves on to an analysis of the empirical results. The last part of the study summarizes the most important results of the analysis which was carried out.

Literature review

The real estate market represents a significant segment of the economy and plays an important role in achieving the objectives of national stability and economic development. Because of that, a great number of authors have examined the influence of key macroeconomic variables on real estate price trends from various angles and by using different approaches and methods.

Egert and Mihaljek (2007) examine whether the fundamental determinants of real estate prices, such as GDPpc, real interest rates, mortgages and demographic factors influence prices in eight transition economies from Central and Eastern Europe (CEE) and nineteen OECD countries, by applying the panel Dynamic Ordinary Least Squares (DOLS) technique. It shows that GDP elasticity coefficients values, real interest rates and demographic factors are higher in transition countries than in OECD countries, meaning that real estate prices react more significantly in transition countries than in OECD countries to the same change in these macroeconomic factors. On the other hand, when it comes to mortgage availability, real estate prices reacted to changes in this variable twice as much in OECD countries as in CEE countries.

The influence of factors such as real GDP, real interest rates, mortgages and the construction output index on real estate prices in transition economies has been researched in a study by Posdel and Vizek (2009) in which they applied a VAR model and multiple regression. It showed that real interest rates, real GDP and the persistence of real estate prices have greater significance in explaining real estate price variance. Their results are partially consistent with the results of the study by Egert and Mihaljek (2007); however, the main distinction of this study is that GDP has only a secondary importance in determining real estate prices. In her subsequent research, Vizek (2010) used the co-integration and ECM model to determine the behavior of real estate prices in both the short term and the long term in post-transition and developed EU economies. The research results show that long-term interest rates explain the variations in prices in both groups of countries, whereas changes in income are relevant only for Western European countries. In the short-term, real estate prices in all the examined countries react to changes in construction activities. Price persistence is also shown to be important. Changes in mortgages influence the short-term behavior of real estate prices, but only in post-transition countries.

Apergiz and Rezitis (2003) analyzed the dynamic effects of macroeconomic variables (mortgage interest rates, inflation, and employment) on real estate prices in Greece by implementing the ECVAR (error correction vector autoregressive) model. Impulse response function showed that the shock on the side of the housing interest rate (increase) lowers the real estate price, whereas the shock on the side of the consumer prices and employment increases its price. Variance decomposition, on the other hand, showed that the mortgage interest rate is the variable which has the biggest explanatory power in explaining the variations of housing prices, and then the consumer prices and employment. An analysis was carried out by Panagiotidis and Printzis (2015) for the same geographical market where they examined the interdependence of the real estate price indexes and its macroeconomic determinants by using the ECM framework. It was shown that the retail

sector and mortgage loans are the most significant determinants of the real estate prices in Greece.

Unemployment rate, as one of the most important factors which explains the real estate price trends was reviewed by Leung, Leung and Wong (2006). In their research, they applied Ordinary Least Squares (OLS) and Principal Component Method, which describes whether the real estate price dispersion is related to microeconomics. Obtained results point to the fact that the real estate price rises when there is a rise in real interest rate, budget ratio, mortgage rate and real shares price, and when there is a decline in the inflation rate, the trade ratio, the economic growth rate and the unemployment rate. In addition to the above mentioned authors, Grum and Govekar (2016) examine the relationship between the unemployment rate and other macroeconomic factors and real estate prices in different cultural environments by the implementation of a multiple linear regression model. A statistically significant negative correlation between the unemployment rate and real estate prices was demonstrated in France, Greece, Norway and Poland, whereas a statistically significant positive correlation was determined in the case of Slovenia with share prices. Additionally Kotseva and Yanchev (2017) concluded through their analysis of real estate market development that the factors of unemployment and uncertainty related to future income can be viewed as the most significant in relation to demand and that they have had the primary influence on the continuous real estate price decrease since the beginning of the global crisis in 2008.

By applying the correlation and regression analysis, Gaspareniene, Remeikiene and Skuka (2016) showed that the interest rate and the availability of mortgages have the biggest influence on real estate prices in Lithuania, whereas inflation and GDP are not significant in explaining the variations in housing prices. On the other hand, the research carried out by the implementation of the Analytic Hierarchy Process (AHP) methods by Tupenaite, Kanapeckiene and Naimaviciene (2017) confirmed that the fluctuation within the real estate market in Lithuania were mostly influenced by the interest rate and the rate of approved mortgages. However, unlike the previously mentioned authors, this study determined a significant influence from inflation. While the research in Lithuania showed that interest rates have the strongest influence on real estate price trends, research carried out in Cyprus showed that the influence of interest rates was negligible. GDP had the greatest effect on real estate price trends, followed by construction costs and the number of households (Sivitanides 2015), which makes these results almost identical to the findings of Pashardes and Savva (2009), even though these authors found that the population caused the most significant effect on prices.

The analysis of real estate price determinants in Croatia in terms of both the short and long term was carried out by implementing the ECM model and co-integration method in a study by Lovrinevic and Vizek (2008). They single out

approved mortgages, inflation and the dynamics of marriage as crucial determinants for the short term. As far as the long term is concerned, they point out that income has a greater influence than construction activities, in that the income flexibility of real estate prices in the long term (6.28%) is almost three times greater than the flexibility of real estate prices as compared to changes in supply (1.75%). Furthermore, an increase in the interest rate of 1% in the long term leads to a decrease in real estate prices of 0.28%. The results of this research point to the correlation between inflation and real estate prices and also the growth of general level of prices, which shows a positive correlation with real estate prices, and thus investment in real estate is regarded as a protection mechanism against inflation. On the other hand, through the panel regression of 15 OECD countries, Adams and Fuss (2010) determined that growth in economic activity of 1% leads to long term growth in real estate prices of 6% and that increases in long term interest rates lead to decreasing real estate prices. By applying the same model (ECM and co-integration model), Weiner and Fuerst (2015) show that the lack of supply of real estate in the long term, together with population growth, explains the majority of real estate price increase. The demand factors, such as interest rate decreases, together with decreasing unemployment rates and cost of rent increase also proved important in explaining the dynamics of real estate prices. The most interesting discoveries in terms of long term relationships include stock-market-price-index movement, where empirical evidence for the substitution effect was found, according to which the real estate market and stock market act as independent alternative investment markets for both households and investors.

According to data provided for six developed economies, Allen, Barnes and Lynch (2016) show that real estate price can be interpreted as a function of macroeconomic variables (real GDP growth rate, current account balance, the imbalance between investments and savings and public debt). The conclusion of the research is that the macroeconomic system with a high real GDP growth rate, growing current account deficit and a low savings rate compared with investment consumption at full employment level and high public debt, has a greater probability to create a housing bubble.

However, certain groups of authors describe and show an opposite trend – the influence of real estate prices on macroeconomic factors. Thus, Meidani, Zabihi and Ashena (2011) show that there is a significant multi-directional connection between real estate prices and macroeconomic factors (notably GDP and inflation). In addition Gustafsson, Stockhammar and Osterholm (2016) quantify the effects of real estate price decreases in Sweden in terms of the unemployment rate and household consumption and show that a real estate price decrease of 20% leads to a recessional influence on both consumption and unemployment. The effect would have been even greater if the real estate price decrease had matched with the glob-

al decrease in economic activity. Apart from that, extensive testing of whether the change in real estate prices of houses easily spread to the rest of the economy and how domestic variables, especially financial conditions, influence real estate prices, as well as the external shocks, has been conducted for Croatia. Dumici, Casni and Sprajacek (2012) used the Structural Vector Auto Regression (SVAR) model with five variables and showed that foreign GDP represents the main source of total volatility in domestic variables. The real estate price trend has a significant influence on domestic variables, but especially on financial conditions, and reveal an important connection between financial stability and real estate prices.

The authors of this study chose the first approach, i.e. researching the influence of macroeconomic variables on real estate prices and also on how much real estate price fluctuations can be explained by factors including average national income, mortgage interest rates and mortgage availability, construction activity, the inflation rate, the unemployment rate and net salary, foreign direct investments and current account deficit.

Data description

This study used quarterly data starting from the first quarter of 2011 and ending with the third quarter of 2017¹. It was obtained from two sources: the: Central Bank of Montenegro and the Statistical Office of Montenegro (MONSTAT).

The dependent variable in the model is the real estate price, and the data on its value was obtained from MONSTAT. This price refers to the agreed price of the usable area of apartments sold in a new building in exclusively residential, mostly residential and mostly non-residential buildings. The independent variables in the model are the available macroeconomic indicators, specifically: GDP, the inflation rate, the mortgage interest rate, availability of mortgages, the unemployment rate, the average net salary, the current account deficit and construction activity. Since there is no consistency in the literature in using certain transformations of dependent and independent variables, we decided to model three transformations of each dependent variable and different transformations of the same group of macroeconomic indicators, as is presented in Table 1. The idea of using groups of macroeconomic indicators is motivated by the limitation that only one transformation from the same group of indicators could be used as an independent variable in the same regression model.

¹ In Montenegro, quarterly GDP has been issued only since 2011, whereas the quarterly data on real estate prices has been available since 2010.

Table 1.

DEPENDENT AND INDEPENDENT VARIABLES

Variable	Variable Transformation	Symbol	Expected sign
Real estate price (dependent variable)	Real estate price - absolute amount	REP_AMT	
	Real estate price – quarter on quarter change	REP_QOQ	
	Real estate price – year on year change	REP_YOY	
GDP	GDP – year on year change	GDP_YOY	+
	GDP – nominal GDP	GDP_CUP	+
	GDP – real GDP	GDP_COP	+
	Foreign direct investments as a part of GDP – absolute amount	GDP_FDI	+
Availability of mortgages	Mortgages – absolute amount	HL_AMT	+
	Mortgage interest rate	HL_IR	-
Construction activity indicator	Construction activity – absolute amount	CONSTR_AMT	-
	Construction activity index	CONSTR_IND	-
Unemployment rate		UNEMP	-
Average net salary		SAL	+
Inflation rate – harmonized index of the consumer prices		HICP	+
Current account deficit		DEF	-

It is important to note that due to the short time series and the theoretical correlation of FDI and GDP, but also in order to avoid the problem of multicollinearity, FDI are included in the GDP group through the index GDP_FDI. From the same reason, mortgages in absolute amounts and mortgage interest rates are categorized in the same indicator group.

The last column in Table 1 represents the direction of influence of each of the independent variables on the dependent ones. Economic theory suggests that the relationship between real estate prices and GDP is positive. Any improvement in economic performance expressed by the increased values of GDP leads to an increase in total demand, which includes the demand for real estate as well. The increase in the real estate price appears as a consequence, thus the restriction of the sign in the assessed models is positive.

An increase in the inflation rate encourages economic subjects to invest in real estate in order to protect their wealth against losing value, which might lead to increases in real estate prices as a consequence. On the other hand, increases in interest rates makes real estate purchase less attractive and lead to a decrease in demand and real estate prices. Mortgage availability in economic theory represents an important determinant of real estate prices, because the majority of the population uses mortgages as the main source of financing such purchases. In order to avoid a decrease in the value of their capital, which occurs when real estate prices go down, banks offer large amounts of mortgages in order to stimulate the demand for real estate and thus, raise its price.

The theory emphasizes a strong connection between the current account deficit and real estate prices. A high level of deficit points to large inflows of foreign capital which increases the funds available to finance housing purchase, which leads to increased demand for real estate and increased prices.

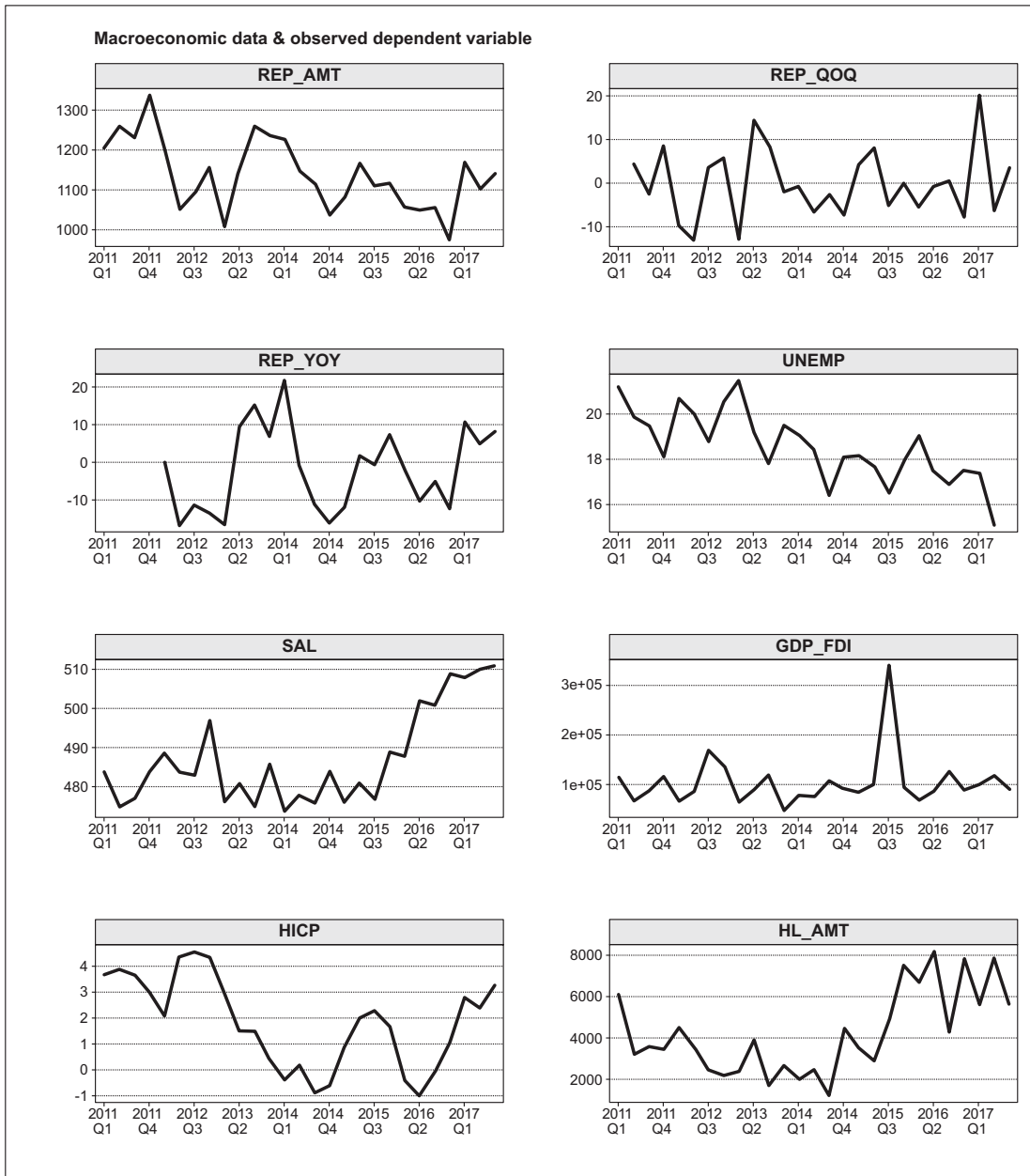
While analyzing the influence of employment and net salaries, theory points to a positive relationship between these two variables and real estate prices, as well as a negative relationship with regards to the unemployment rate. Any increase in employment leads to a increase in salaries as well as the purchasing power of the population, including real estate purchases, which causes an increase in real estate prices.

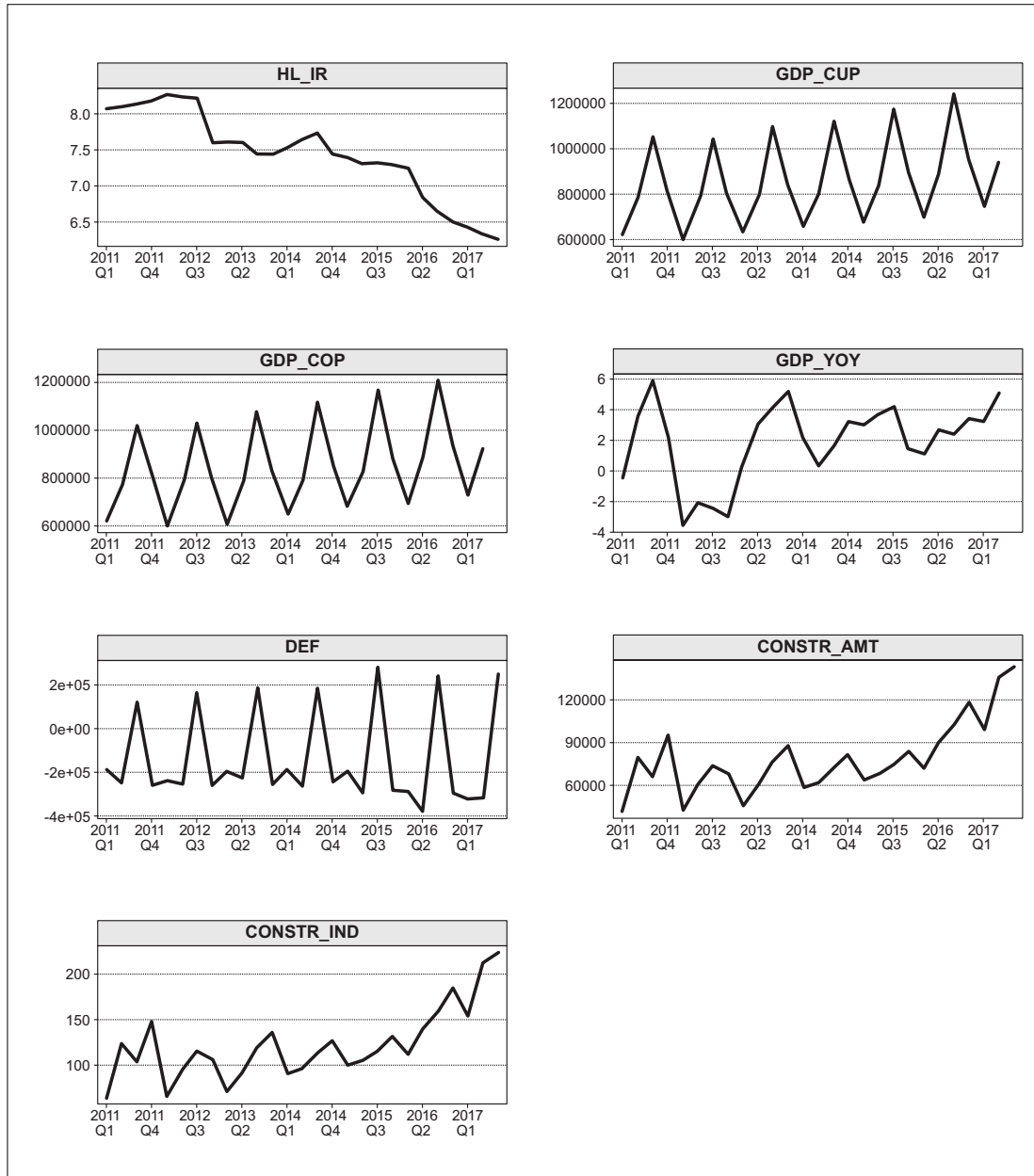
Another factor in real estate demand is construction activity. Increased construction activity increases the real estate supply, which leads to a decrease in real estate prices.

The trends in the macroeconomic indicators for the observed period are shown in Figure 1.

Figure 1.

MACROECONOMIC INDICATOR TRENDS





Macroeconomic indicators in Montenegro are characterized by seasonal oscillations; thus a significant growth in economic activity is noticed in the third quarter, which coincides with the duration of the tourist season. In the same period, the unemployment rate shows a decrease in its value for the same reason.

Apart from that, in the third quarter in 2015, FDI reached its maximum, which is attributed to intensive construction activity in the southern region. Additionally, there is a trend towards an increase in construction activity to the construction of the first highway in Montenegro.

A summary of the descriptive statistics for previously defined variables is presented in Table 2.

Table 2.

DESCRIPTIVE STATISTICS FOR THE CHOSEN VARIABLES

Variable	Mean	Std_dev	Min	Max
REP_AMT	1,139.2593	87.1765	975.0000	1,337.0000
REP_QOQ	0.1003	8.0682	(12.9032)	20.2051
REP_YOY	(1.7786)	11.0956	(16.6253)	21.7262
UNEMP	18.5668	1.5556	15.1000	21.5000
SAL	487.2222	12.0650	474.0000	511.0000
GDP_FDI	104,853.4787	53,640.4850	48,260.1095	340,704.0537
HICP	1.8296	1.7560	(1.0000)	4.6000
HL_AMT	4,261.3704	2,038.2382	1,209.0000	8,206.0000
HL_IR	7.4400	0.6082	6.2600	8.2700
GDP_CUP	858,797.2692	176,157.3928	601,355.0000	1,241,046.0000
GDP_COP	848,168.1538	172,627.0666	602,198.0000	1,208,910.0000
GDP_YOY	1.9577	2.5588	(3.6000)	5.9000
DEF	(139,148.2479)	211,468.3644	(377,011.8848)	284,182.5509
CONSTR_AMT	78,753.6296	25,166.8198	41,826.0000	143,417.0000
CONSTR_IND	122.6404	39.1915	65.1351	223.3000

In the analyzed period, the average price of real estate was EUR 1,139 per m², with a maximum achieved in the fourth quarter of 2011 and a minimum of EUR 975 per m² in the fourth quarter of 2016. The average GDP growth rate in the same period was 1.96% with a maximum of 5.9% achieved in the third quarter of 2011 and a minimum of -3.6% in the first quarter of 2012. With regards to mortgages, their average amount was EUR 4,261,370, with a maximum amount of EUR 8,206,000 in the second quarter of 2016, and a minimum in the third quarter of 2014. The average interest rate for these loans was 7.4% with a maximum of 8.27% in the first quarter of 2012 and the minimum of 6.26% in the third quarter of 2017.

Methodology

Due to the limited ratio of data points to macroeconomic indicators, we employed statistical techniques motivated by a model averaging approach. Specifically in such cases standard variable selection methods can often be misleading (a phenomenon known as Freedman's paradox, Freedman 1983). Therefore, we estimated all the possible linear models of one and two macroeconomic indicator combinations, with time lags from zero to four quarters.

Variables are modeled in the first difference due to the opposite results of stationarity test (KPSS, PP, ADF) of REP². The same macroeconomic indicator with different transformations (e.g. GDP_YOY and GDP_COP) are restricted not to belong to the same model as well as the same macroeconomic indicator with a different time lag. If the estimated model has a Durbin-Watson p-value of less than 5%, heteroscedasticity and autocorrelation consistent (HAC) standard errors are calculated and the coefficient significance is reviewed based on these standard errors. Out of all the estimated models, we selected only the models that fulfill the following criteria:

1. The estimated sign of the independent variable is in line with economic expectations.
2. All the estimated coefficients are statistically significant at a 5% significance level.
3. The p-value of the Shapiro-Wilk normality test of residuals is greater than 5%.
4. No multicollinearity exists measured by the variance inflation factor at a 5% significance level.
5. The adjusted R squared is greater than 0.

Three transformations of dependent variable were used and the significance and influence of macroeconomic indicators were examined for each of them. Previous research has show the usage of various transformations of dependent and independent variables, therefore we decided (for the dependent variable) on the direct modelling of real estate prices, quarter by quarter and year by year changes in real estate prices. The independent variables (the macroeconomic indicators)

² KPSS - Kwiatkowski-Phillips-Schmidt-Shin tests, PP - Phillips-Perron test, ADF - Augmented Dickey-Fuller test

REP_AMT: KPSS p-value 3%, PP p-value 7%, ADF p-value 28%

REP_QoQ: KPSS p-value 10%, PP p-value 1%, ADF p-value 19%

REP_YoY: KPSS p-value 10%, PP p-value 21%, ADF p-value 20%

were also used as absolute amounts and as percentage changes, with the limitation that the same indicator with two different transformations cannot be found in one model.

Results

The previously explained approach was used to examine all the possible combinations of one and two independent variables with a time lag from zero to four quarters and 4,530 models were assessed. Out of all the assessed models, we chose 15 which met the given criteria, from which we obtained ten dual-factor and six single-factor models.

The results show that, regardless of the transformation of the variable used (dependent and independent) the current account deficit and inflation rate were not found to be statistically significant, and nor were either of the indicators which describes construction activity (CONSTR_AMT and CONSTR_IND). The only GDP transformation which appears in all the chosen models is GDP_YOY. In all the models, the indicators affect the dependent variable with a certain time lag.

The assessed models for REP_AMT are presented in **Table 3**.

Table 3.

ASSESSED MODELS FOR REP_AMT

Dependent	Model ID	# of variables	coefficients	Estimate	StdError	t-value	p-value	Stand. coefficient	R ²	Adj. R ²	Shapiro p-value	BIC	AIC	DW p-value	p-value HAC
REP_AMT	Model:819	2	lag(d(GDP_YOY), -1)	25.56	6.18	4.14	0,05%	0.62	54,91%	50,61%	77,81%	263.06	259.65	0,60%	0,00%
REP_AMT	Model:819	2	lag(d(SAL), -3)	3.37	1.52	2.21	3,84%	0.33	54,91%	50,61%	77,81%	263.06	259.65	0,60%	0,04%
REP_AMT	Model:683	2	lag(d(HL_AMT), -1)	0.02	0.01	2.77	1,10%	0.40	53,03%	48,94%	44,25%	285.92	282.27	7,60%	1,10%
REP_AMT	Model:683	2	lag(d(GDP_YOY), -1)	24.59	5.59	4.39	0,02%	0.63	53,03%	48,94%	44,25%	285.92	282.27	7,60%	0,02%
REP_AMT	Model:830	2	lag(d(GDP_YOY), -1)	27.03	7.23	3.74	0,13%	0.64	41,39%	35,53%	57,78%	256.59	253.32	2,80%	0,00%
REP_AMT	Model:830	2	lag(d(HL_IR), -4)	60.93	81.63	0.75	46,41%	0.12	41,39%	35,53%	57,78%	256.59	253.32	2,80%	1,44%
REP_AMT	Model:21	1	lag(d(GDP_YOY), -1)	23.92	6.32	3.79	0,09%	0.61	37,41%	34,80%	70,73%	289.88	287.45	2,00%	0,00%
REP_AMT	Model:38	1	lag(d(SAL), -3)	4.38	1.98	2.21	3,78%	0.42	18,17%	14,45%	81,71%	273.63	271.36	23,40%	3,78%

The influence of the macroeconomic factors modelled on real estate price (REP_AMT) is explained by two single-factor and three double-factor models, where GDP_YOY, SAL, HL_AMT and HL_IR appear as statistically significant variables. In all the double-factor models, the variable which explains the trend in real estate prices best is GDP_YOY, whose average influence on the dependent variable is 25.72, meaning that a increase in the GDP growth rate for 1% leads to the increase in the real estate price of EUR 25.72, with a time lag of one quarter. In combination with SAL, which operates with a time lag of 3 quarters and whose increase by EUR 1 brings an increase in real estate price for EUR 3.37, GDP_YOY explains 54.91% of real estate variations. On the other hand, those variables which have common influence on the dependent variable, should describe also its trend individually, which is further confirmed by the single-factor models, where the determinant coefficient (R^2) for these models is 37.41% (for GDP_YOY), and 18.17% (for SAL), respectively. In combination with HL_AMT, which operates with a time lag of one quarter and the increase of which by EUR 1,000,000 leads to an increase in real estate price by EUR 18.90, GDP_YOY explains a total of 53.03% of real estate price variation.

The assessed models for REP_QOQ are presented in **Table 4**.

Table 4.

ASSESSED MODELS FOR REP_QOQ

Dependent	Model ID	# of variables	Coefficients	Estimate	StdError	t-value	p-value	Stand. coefficient	R ²	Adj. R ²	Shapiro p-value	BIC	AIC	DW p-value	p-value HAC
REP_QOQ	Model:683	2	lag(d(HL_ AMT), -1)	0.00	0.00	3.12	0.48%	0.51	39,81%	34,57%	50,37%	195.74	192.08	2,80%	0,02%
REP_QOQ	Model:683	2	lag(d(GDP_ YOY), -1)	2.27	0.92	2.47	2,15%	0.40	39,81%	34,57%	50,37%	195.74	192.08	2,80%	0,01%
REP_QOQ	Model:819	2	lag(d(GDP_ YOY), -1)	2.31	1.14	2.02	5,67%	0.38	28,48%	21,67%	72,85%	185.52	182.11	0,20%	0,00%
REP_QOQ	Model:819	2	lag(d(SAL), -3)	0.49	0.28	1.72	9,97%	0.32	28,48%	21,67%	72,85%	185.52	182.11	0,20%	2,84%
REP_QOQ	Model:17	1	lag(d(HL_ AMT), -1)	0.00	0.00	2.74	1,13%	0.49	23,88%	20,71%	59,68%	198.39	195.95	1,80%	1,34%
REP_QOQ	Model:1219	2	lag(d(UNEMP), -3)	- 3.03	1.88	- 1,61	12,15%	- 0,31	24,05%	16,81%	98,86%	186.90	183.49	0,80%	4,56%
REP_QOQ	Model:1219	2	lag(d(SAL), -3)	0.68	0.29	2.32	3,04%	0.45	24,05%	16,81%	98,86%	186.90	183.49	0,80%	1,42%
REP_QOQ	Model:1244	2	lag(d(SAL), -3)	0.77	0.33	2.33	2,97%	0.51	20,73%	13,18%	43,17%	187.88	184.48	0,20%	0,79%
REP_QOQ	Model:1244	2	lag(d(HL_ IR), -3)	20.13	15.83	1.27	21,73%	0.26	20,73%	13,18%	43,17%	187.88	184.48	0,20%	2,55%
REP_QOQ	Model:1241	2	lag(d(SAL), -3)	0.67	0.30	2.22	3,78%	0.44	20,72%	13,17%	100,00%	187.89	184.48	0,00%	3,10%
REP_QOQ	Model:1241	2	lag(d(GDP_ FDI), -3)	0.00	0.00	1.27	21,77%	0.25	20,72%	13,17%	100,00%	187.89	184.48	0,00%	1,25%
REP_QOQ	Model:21	1	lag(d(GDP_ YOY), -1)	2.15	1.08	2.00	5,71%	0.38	14,27%	10,70%	91,04%	201.36	198.92	0,80%	0,12%
REP_QOQ	Model:37	1	lag(d(UNEMP), -3)	- 2.06	2.01	- 1.02	31,67%	- 0,21	4,56%	0,22%	79,16%	189.02	186.75	2,00%	2,24%

The influence of the macroeconomic indicators modelled on the QOQREP change is explained by five double-factor and three single-factor models, where the statistically significant variables are GDP_YOY, GDP_FDI, HL_AMT, HL_IR, SAL and UNEMP. In the double-factor models where SAL appears as one of the independent variables, in combination with any other variable, it has a stronger influence on real estate price trends, except when used in combination with GDP_YOY. Comparing the GDP_YOY standardized coefficient in this model, with its value in the model where the dependent variable is REP_AMT, we define that its value is almost twice as low and amounts to 0.38 (compared with a level of 0.62 from the first three transformations). The average influence of SAL on real estate prices in the double-factor models amounts to 0.65 i.e. an increase in salaries of EUR 1 leads to an increase in real estate price of 0.65% with a time lag of three quarters. In the model where HL_AMT appears as one of the independent variables, its influence on the real estate price trend is shown as more significant in relation to the alternate explanatory variable, and specifically from GDP_YOY. On average, the increase in the loan amount of EUR 1,000,000 leads to an increase in real estate price of 3.5% with a time lag of one quarter. The model which contains the combination of these two factors has the highest coefficient of determination, at 39.81%. The average influence of GDP_YOY on the real estate price in double-factor models amounts to 2.29, i.e. an increase in GDP growth of 1% leads to an increase in real estate prices of 2.29% with a time lag of one quarter. The unemployment rate, as a statistically significant factor that influences real estate price, in combination with SAL, explains 24.05% of the variations in the dependent variable. An increase in the unemployment rate of 1% leads to a decrease in real estate price of 3.03% with a time lag of 3 quarters. The model which contains SAL and HL_IR explains 20.73% of the variations in real estate price, where an increase in mortgage interest rate of 1% leads to an increase in real estate prices of 20.13%. An increase in FDI values of EUR 1,000,000 leads to an increase in real estate prices of 0.04% with a time lag of three quarters. This factor, in combination with SAL, explains 20.72% of all real estate price variations.

In single-factor models, the best explanatory variables are HL_AMT, GDP_YOY and UNEMP. Out of these three single-factor models, the highest coefficient of determination (R^2) is shown by the model with HL_AMT (23.88%) and the lowest is provided by the model with UNEMP (4.56%). It is interesting that among the single-factor models, no model has SAL as an independent variable, although it is statistically important in double-factor models.

The assessed models for REP_YOY are presented in **Table 5**.

Table 5.

ASSESSED MODELS FOR REP_YOY

Dependent	Model ID	# of variables	Coefficients	Estimate	StdError	t-value	p-value	Stand. coefficient	R ²	Adj. R ²	Shapiro p-value	BIC	AIC	DW p-value	p-value HAC
REP_YOY	Model:818	2	lag(d(GDP_YOY), -1)	4.19	0.78	5.35	0,00%	0.73	62,52%	58,77%	85,05%	158.91	155.63	6,20%	0,00%
REP_YOY	Model:818	2	lag(d(UNEMP), -3)	- 2,89	1.19	- 2,43	2,44%	- 0,33	62,52%	58,77%	85,05%	158.91	155.63	6,20%	2,44%
REP_YOY	Model:21	1	lag(d(GDP_YOY), -1)	4.10	0.87	4.71	0,01%	0.72	51,41%	49,10%	13,89%	161.52	159.34	6,00%	0,01%

The least number of combinations of statistically significant variables was obtained in modelling the influence of macroeconomic indicators on the YOY REP change where we obtained only one single-factor and one double-factor model with GDP_YOY and UNEMP. The combination of GDP_YOY and UNEMP explains 62.52% of the variations in the real estate price index, where the influence of GDP_YOY is more than twice as high as the influence of the unemployment rate (taking into account the standardized coefficient of 0.73 for GDP_YOY, whereas the value of the coefficient for UNEMP is 0.33). An increase in the unemployment rate of 1% leads to a decrease in the real estate price of 2.89% with a time lag of three quarters, whereas an increase in the GDP growth rate of 1% leads to an increase in the real estate price of 4.19% with a time lag of one quarter.

Depending on the method of defining the dependent and independent variables, the conclusions on significant macroeconomic indicators change significantly. The results of the analysis show that the only variable that occurs in all models, regardless of the transformation, is GDP_YOY, while the others appear depending on the transformation of the dependent variable. In the first transformation, SAL is significant, in the second SAL and HL_AMT are significant, and in the third transformation only UNEMP shows any significance. In the first and third transformation of the dependent variables, GDP_YOY has a greater explanatory power as to the movement of the dependent variable than any other independent variable in the model, while in the second transformation HL_AMT is of greater significance than GDP_YOY.

Conclusion

This study has investigated whether the real estate price trend in Montenegro can be explained by macroeconomic factors and which of the factors are most significant in explaining price trends. Compared with existing studies which examine this topic, this analysis used a different approach based on the model averaging technique. Additionally, the time lags which delay the effects of macroeconomic variables have been measured.

Based on the results obtained, real estate price trends can be best described by GDP and, more specifically, by its transformation - GDP_YOY. This variable influences real estate prices with a time lag of one quarter. However, another GDP transformation, which stands out as significant is GDP_FDI, which operates with the time lag of three quarters. Apart from GDP, we determined the significance of SAL, HL and UNEMP as variables which describe price trends as related to the real estate market. Within the indicators related to mortgages, the most significant

are both interest rate HL_IR (which operates with a time lag of four quarters) and the availability of mortgages HL_AMT (which operates with a time lag of one quarter).

On the other hand, the results show that there is a connection between the real estate market and the labour market, as SAL and UNEMP are demonstrated to be statistically significant in the model, operating with the same time lag of three quarters.

By examining the literature, we noticed that income and interest rates are the two most commonly used determinants which explain real estate price trends. Since these two variables contain important information on real estate market trends, they might also be used in predicting the dynamics of this market (Kishor and Marfatia 2014), which was confirmed by our research. Apart from that, although certain previous research considered inflation as a significant factor which influences real estate prices (Apergiz and Rezitis 2003; Leung et al. 2006; Tupenaite et al. 2017, Tsatsaronis and Zhu, 2004, and others), the results of our research show that this variable is not significant in explaining the dependent variable. Furthermore, the same result is obtained for the current account deficit, as well as for construction activity indicators.

According to latest research, macroeconomic fundamentals have strong predictive power for future movements in real estate prices (Bork and Moller, 2016), which is also confirmed with our study. Therefore, an important implication of our study is that macroeconomic stabilization policy affects real estate market. If a positive macroeconomic environment in Montenegro prevails (positive economic growth rates, low unemployment rates, increase in FDI etc.), significant positive effects on real estate prices can be expected. Policymakers need to take into account different time lags which delay the effects of macroeconomic variables when forecasting the effects of certain policies on real estate market movements.

Although the research is limited by its short time series, the application of this econometric technique enabled us to evaluate the influence of significant macroeconomic variables. The results obtained point to different conclusions related to the transformation of dependent and independent variables, so that during the presentations of the results, we should also consider the above-mentioned transformations. Since this is the first research of this type in Montenegro, recommendations for future research include the potential for comparative analysis with the surrounding countries in the region, as well as with established EU countries.

References:

1. Adams, Z. - Fuss, R. (2010): Macroeconomic Determinants of International Housing Markets. *Journal of Housing Markets*, 19, (1), 38-50.
2. Allen, L. - Barnes, C. - Lynch, H. (2016): The Role of Macroeconomic Fundamentals in the Determination of House Prices. *Journal of Applied Business and Economics*, Vol. 18, Iss. 5, 42-48.
3. Apergis, N. - Rezitis, A. (2003): Housing Prices and Macroeconomic Factors in Greece: Prospects within the EMU. *International Real Estate Review*, Vol. 6, No. 1, 63-74.
4. Arestis, P. - González, A. R. (2014): Modelling the housing market in OECD countries. *International Review of Applied Economics*, Volume 28, Issue 2, 131-153
5. Bork, L. – Moller, S.V. (2016): Housing Price Forecastability: A Factor Analysis. *Real Estate Economics*, Vol.46(3), pp.582-611
6. Dumičić, K. - Časni, A. Č. - Šprajčak, P. (2012): The Linkage Between Real Estate Prices and the Macroeconomy in Croatia: VAR Approach. *Croatian Operational Research Review (CRORR)*, Vol. 3, 289-299.
7. Egert, B. - Mihaljek, D. (2007): Determinants of house prices in Central and Eastern Europe. *Comparative economic studies*, 49 (3), 337–489.
8. Freedman, D.A. (1983), A note on screening regression equations. *The American Statistician* 37: 152–155
9. Grum, B. - Govekar, D. K. (2016): Influence of Macroeconomic Factors on Prices of Real Estate in Various Cultural Environments: Case of Slovenia, Greece, France, Poland and Norway. *Procedia Economics and Finance*, Volume 39, 2016, 597-604.
10. Gustafsson, P. - Stockhammar, P. - Osterholm, P. (2016): Macroeconomic effects of a decline in housing prices in Sweden. *Journal of Policy Modeling*, Vol. 38, Issue 2, 242-255.
11. Jorda, O. – Schularick, M. – Taylor, A.M. (2015): Betting the house. *Journal of International Economics*, vol.96(S1), pp.2-18
12. Kishor, N. K. - Marfatia, H. A. (2014): The dynamic relationship between housing prices and the macroeconomy: Evidence from OECD countries. *Journal of Real Estate Finance and Economics*, 54(2), 1-32.
13. Kotseva, P. - Yanchev, M. (2017): Analysis of the Housing Market Developments and the Underlying Macroeconomic Fundamentals in Bulgaria. Discussion Papers: *Bulgarian National Bank Publications*. January 2017.

14. Leung, C. K. Y. - Leung, Y. C. F. - Wong, S. K. (2006): House Price Dispersion and Empirical Investigation. *Journal of Real Estate Finance and Economics*, Volume 32, Issue 3, 357–385.
15. Ligita Gaspareniene - L., Remeikiene; R. - Skuka, A. (2017): Assessment Of The Impact Of Macroeconomic Factors On Housing Price Level: Lithuanian Case. *Intellectual Economics*, 10 / 2016, 122-127.
16. Lovrinčević, Ž. - Vizek, M. (2008): Determinants of real estate prices in the Republic Croatia and potential factors of the real estate market liberalization. *Economic Review*, 59(12), 723-740.
17. Lovrinčević, Ž. - Vizek, M. (2008): Determinants of real estate prices in the Republic Croatia and potential factors of the real estate market liberalization. *Economic Review*, 59(12) 723-740.
18. Meidani, A. A. N. - Zabihi, M. - Ashena, M. (2011): House Prices, Economic Output and Inflation Interactions in Iran. *Research in Applied Economics*. Vol. 3, No. 1.
19. Meltem, S. U. - Gokkent, G. (2009): Macroeconomic Factors Affecting Real Estate Markets in Turkey: A VAR Analysis Approach. *Briefing Notes in Economics*, Issue No. 80, March/April 2009.
20. Panagiotidis, T. - Printzis, P. (2015): On the macroeconomic determinants of the housing market in Greece: A VECM approach. *GreeSE Paper No. 88, Hellenic Observatory Papers on Greece and Southeast Europe*, European Institute, London, UK.
21. Pashiardes P. - C. S. Savva. (2009): Factors Affecting House Prices in Cyprus: 1988-2008. *Cyprus Economic Policy Review*, 3:1, 3-25.
22. Posedel, P. - Vizek, M. (2009): House Price Determinants in Transition and EU-15 countries. *Post-Communist Economies*, Vol. 21, No. 3, 327-343.
23. Sivitanides, P. (2015): Macroeconomic Influences on Cyprus House Prices: 2006Q1-2014Q2, *Cyprus Economic Policy Review*, vol. 9, no. 1, pp. 3-22.
24. Tsatsaronis, K. – Zhu, H. (2004): What Drives Housing Price Dynamics: Cross-Country Evidence. *BIS Quarterly Review*, March 2004, pp.65-78
25. Tupenaite, L. - Kanapeckiene, L. - Naimaviciene, J. (2017): Determinants of Housing Market Fluctuations: Case Study of Lithuania. *Procedia Engineering*. Volume 172, 1169-1175.
26. Vizek, M. (2010): Short-run and Long-run Determinants of House Prices in Eastern and Western European Countries. *Economic trends and economic policy*, 125 / 2010, 27-59.
27. Weiner, D. - Fuerst, F. (2015): The Dynamics of House Prices in Israel. Department of Land Economy, *University of Cambridge Working Paper*, 2015-12.

UTJECAJ MAKROEKONOMSKIH FAKTORA NA CIJENE NEKRETNINA: DOKAZI IZ CRNE GORE

Sažetak

Tržište nekretnina, kao jedan od najvolatilnijih gospodarskih sektora, za mnoge je autore ključna tema istraživanja. Ipak, bez obzira na značaj ove teme, nijedno istraživanje nije provedeno da bi se ocijenili faktori koji utječu na cijenu nekretnina u Crnoj Gori. Stoga je cilj ove studije razjasniti može li se trend cijena nekretnina u Crnoj Gori objasniti makroekonomskim fundamentima kao što su BDP, stopa inflacije, kamatne stope na stambene kredite, stambeni krediti, stopa nezaposlenosti, prosjek neto plaće, deficit tekućeg računa i građevinske aktivnosti te odrediti koja je od njih najvažnija u objašnjavanju kretanja cijena za ovo tržište. Primijenjena metodologija temelji se na model averaging tehnici koja se nije koristila u prethodnim istraživanjima na ovu temu; to omogućuje da se istraživanje usredotoči na relevantne rezultate unatoč kratkim vremenskim serijama i velikom broju neovisnih varijabli. Dobiveni rezultati ukazuju na činjenicu da kretanja cijena nekretnina najbolje opisuju i najviše se podudaraju s BDP-om. Osim BDP-a, neto plaće, stopa nezaposlenosti kao i stambeni krediti i njihove kamatne stope pokazali su se značajnim kao varijable koje određuju kretanja cijena na tržištu nekretnina.

Ključne riječi: determinante cijena nekretnina, makroekonomski faktori, tržište nekretnina, model averaging tehnika