

THE IMPACT OF MACROECONOMIC FACTORS ON THE CAPITAL MARKET OF THE REPUBLIC OF SERBIA

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Abstract: *In the study, the impact of five macroeconomic factors on the capital market of the Republic of Serbia was explored. The focus was on factors that have been identified as significant for the development of the capital market but with differing opinions regarding their direction of influence. Specifically, the focus was on GDP, inflation, money supply, interest rate, and exchange rate. The research results indicate that the Belex15 index does not show long-term cointegration with GDP, IPC (inflation), and M3 (money supply). However, there is a significant influence of previous interest rate values and the exchange rate on the capital market of the Republic of Serbia. More precisely, there is a positive impact on interest rates and a negative impact on the exchange rate.*

Keywords: *macroeconomic factors / capital market / cointegration / VECM / Johansen Cointegration Approach.*

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INTRODUCTION

Studying the ability of the capital market to reflect real economic activities through fundamental macroeconomic factors, as well as the ability to predict market movements and stock prices based on changes in macroeconomic factors, represents the most important question for developing countries, considering the role of the capital market in the financial system of these countries. The fundamental puzzle that interests the professional and academic community is whether information about changes in macroeconomic factors is currently reflected in the capital markets of developing countries and whether these effects are the same as in developed capital markets. This is primarily due to the fact that the degree of development and efficiency of capital markets is proportional to the level of development of the national economy (Mishkin & Eakins, 2005), which means that capital markets are determined by specific conditions of a particular national economy. For this reason, the capital market cannot be regarded as an additive and independent factor, as many other macroeconomic factors are precisely reflected in this market. Therefore, studying the level of development of the capital market and the macroeconomic factors that influence its development and efficiency represents an important question for policymakers and investors. On the other hand, research shows that the degree of development of the capital market has an impact on individual macroeconomic factors (Xue, 2020). Hence, uncovering the relationship between different macroeconomic factors and the capital market has become a central question for the academic community, investment practice, as well as macroeconomic policymakers (Ferreira et al., 2012; Albu et al., 2014; Tsurai, 2018; Androniceanu et al., 2019; Stojković et al., 2019; Tvaronaviciene, 2019; Onuora, 2019; Zou et al., 2020; Candera et al., 2021; Molefhi, 2021; Kapingura et al., 2022, etc.). However, the lack of a unified opinion regarding the influence and significance of macroeconomic factors on the development of the capital market affects the inability to draw a universal conclusion and generalize views on this matter. As a result, it is accepted that the question of whether selected factors are significant in explaining and predicting the development and performance of a particular capital market is empirical, and the impact of selected factors should be

studied on a case-by-case basis, taking into account specific conditions of the national economy and the capital market.

Considering the previous statements, on one hand, as well as the specificities of the capital market and macroeconomic conditions in the Republic of Serbia, studying this topic is particularly relevant. The specific macroeconomic conditions stem from the instability of the political environment, unique regulations, monetary and fiscal policies, an incomplete process of economic transition, etc. On the other hand, the capital market of the Republic of Serbia is characterized by a relatively small number of traded securities, low liquidity, and pronounced volatility (Radivojevic et al., 2022). From 2007 to 2021, the capital market of the Republic of Serbia experienced significant fluctuations. A notable decline, both in terms of the number of transactions and the total market capitalization, has been evident since 2008. The number of actively traded securities has also seen a significant decrease. The capital market development model initiated by the Privatization Law of the Republic of Serbia failed to provide sustainable capital market development. After a large number of companies were listed on the Belgrade Stock Exchange in 2005, 2006, and 2007, this number started to decline significantly from 2008 onwards, mainly due to the initiation of bankruptcy proceedings against companies or the termination of their status as public joint-stock companies. Additionally, private companies are generally unwilling to go public, as it leads to ownership diversification. Therefore, borrowing from banks represents the dominant financing method for domestic companies. The low liquidity of the market is also a consequence of distrust in the stock exchange and the reluctance of individual investors to make significant investments in stocks listed on the Belgrade Stock Exchange. The significant influence of the state on the operation of the Belgrade Stock Exchange, along with frequent changes in the legal regulations, further contributes to investor distrust in the Serbian capital market. The fact that stocks of larger companies are traded to a greater extent compared to stocks of smaller issuers affects market volatility. Namely, new information that enters the market first reflects on the stock prices of large companies and only later on the prices of smaller companies. This leads to the occurrence of volatility clusters, making the market highly unstable. On the other hand, the significant influence of the state on the operation of the Belgrade Stock Exchange means that macroeconomic policy measures have a

significant impact on the capital market. Hence, the aim of the research in this paper is to examine the impact of macroeconomic factors on the capital market of the Republic of Serbia. The focus is on five macroeconomic factors: Gross Domestic Product (GDP), inflation, interest rate, money supply, and exchange rate, which have been identified as significant for the development of the capital market but for which there is no unanimous opinion regarding their directional impact.

LITERATURE REVIEW

The intensity and direction of the impact of macroeconomic factors on the capital market primarily depend on the level at which the macroeconomic factor operates, as well as the level of development and structuring of the capital market. There is no consensus in the professional literature regarding the impact of macroeconomic factors on the capital market. The lack of a unified stance on the impact of macroeconomic factors is not unique to authors who have studied developing countries but also applies to those who have examined capital markets in developed countries. Disagreements regarding the significance of the impact of different macroeconomic factors on the capital market of developed and developing countries can be best observed through the analysis of research results from various authors. Table 1 presents the results of research conducted by different authors who examined macroeconomic factors identified as significant for capital markets in developing countries.

Table 1. *Overview of Empirical Research on the Impact of Macroeconomic Factors on the Capital Market.*

Macroeconomic factor	Country/ capital market	Research period	Research method	Impact	Macroeconomic factor Country/ Research period Research method Impact Author
GDP	United States	1953-1987	OLS	A positive influence	Fama (1990)
	Greece	1995-2014	Panel analysis	A positive influence	Laopodis & Papastamou (2016)
	Kong Hong	1992-2016	ARDL	A positive influence	Ho & Odhiambo (2020)
	Saudi Arabia	1985-2018	ARDL	Bidirectional causality	Algaeed (2020)
	Developed EU countries	2004-2016	ARDL	Bidirectional causality	Oprea & Ovidiu Stoica (2018)
	United States	2015-2019	OLS	No influence	Sahoo et al., (2020)
	Germany	2012-2018	OLS	No influence	Celebi & Honig (2019)
	Romania	2003-2019	OLS	A positive influence	Nicolescu (2020)
	Nigeria	1985-2017	VECM	A positive influence	Abina & Lemea (2019)
	Croatia	2009-2014	Panel analysis	A positive influence	Арнерић и Владовић (2021)
	Botswana	2010-2018	ARDL	No impact	Molefhi (2021)
	Hungary	2003-2019	OLS	No impact	Nicolescu (2020)
Inflation	United States	1954-1975	OLS	A positive influence	Fama (1981)
	United States	1953-1971	OLS	Negative influence	Fama & Schwert (1977)
	United States	1953-1983	OLS	Negative influence	Chen et al., (1986).
	Developed countries of Europe	1995-2011	Panel analysis	Negative influence	Şükrüoğlu & Nalin (2014)
	Developed countries of the Asia-Pacific region	1985-2018	ARDL	Negative influence	Candera et al., (2021).
	Kong Hong	1992-2016	ARDL	Negative influence	Ho & Odhiambo (2020)

	United Kingdom	1999 - 2011	VAR	In the long run it affects	Sir (2012)
	United States	2015-2019	OLS	We influence	Sahoo (2020)
	Germany	2012-2018	OLS	We influence	Celebi & Honig (2019)
	Ghana	1992-2019	ARDL	A positive influence	Asravor & Fonu (2020)
	Indonesia	2016-2018	OLS	A positive influence	Assagaf et al., (2019)
	Botswana	2010-2018	ARDL	Negative influence	Molefhi (2021)
	Romania	2003-2019	OLS	Negative influence	Nicolescu (2020)
	Hungary	2003-2019	OLS	No impact	Nicolescu (2020)
	India	2010-2020	VECM	No impact	Kuntamalla & Krishna (2022)
Exchange rate	Germany	2012-2018	OLS	A positive influence	Celebi & Honig (2019)
	United Kingdom	1999 - 2011	VAR		
	Japan, China	2008-2016	VAR		
	Shanghai	2000-2018	ARDL		
	Developed countries of Asia-Pacific	1985-2018	ARDL	Negative influence	Candera et al., (2021),
	Ghana	1992-2019	ARDL	A positive influence	Asravor & Fonu (2020)
	Indonesia	2016-2018	OLS	A positive influence	Assagaf et al., (2019)
	Botswana	2010-2018	ARDL	A positive influence	Molefhi (2021),
	Nigeria	2000-2019	OLS	A positive influence	Oladosu & Akeerebari (2022)
	Botswana	1998-2012	VECM	Negative influence	Onneetse et al., (2014)
	India	2010-2020	VECM	No impact	Kuntamalla & Krishna (2022),
Interest rate	United States	1953-1983	OLS	A positive influence	Chen et al., (1986).
	United Kingdom	1999 - 2011	VAR		

	Kong Hong	1992-2016	ARDL	Negative influence	Ho & Odhiambo (2020)
	Developed countries of the Asia-Pacific region	1985-2018	ARDL	Negative influence	Candera et al., (2021)
	Shanghai	2000-2018	ARDL	Negative influence	Kahn et al., (2021)
	United States	2015-2019	OLS	We influence	Sahoo (2020)
	India	1996-2016	Bai-Perron test	A positive influence	Parab & Reddy (2020)
	Ghana	1992-2019	ARDL	Negative influence	Asravor & Fonu (2020)
	Indonesia	2016-2018	OLS	Negative influence	Assagaf et al., (2019)
	Botswana	2010-2018	ARDL	Negative influence	Molefhi (2021)
	Nigeria	2000-2019	OLS	Negative influence	Oladosu & Akeerebari (2022)
	India	2010-2020	VECM	No impact	Kuntamalla & Krishna (2022)
	South Africa	1975-2015	ARDL	No influence	Ho (2019)
Money supply	United Kingdom	1999 - 2011	VAR	In the long run it affects	Sir (2012)
	United States	1927 - 1987	OLS	A positive influence	Fama & French (1989)
	Germany	2012-2018	OLS	No influence	Celebi & Honig (2019)
	United States of America and Japan	1965-2003	VAR	Negative influence	Humpe et al., (2009)
	Developed countries of Europe	1995-2011	Panel analysis	Negative influence	Şükürüoğlu and Nalin (2014)
	Nigeria	1986-2016	OLS	Negative influence	Ananwude et al., (2017)
	Islamic capital market	2002-2014	VAR	We influence	Bahloul et al., (2016)
	Indonesia	2016-2018	OLS	A positive influence	Assagaf et al., (2019)
	India	1996-2016	VECM	A positive influence	Sahu & Pmndey (2020)

	Botswana	2010-2018	ARDL		
	Nigeria	2000-2019	OLS	A positive influence	Oladosu & Akeerebari (2022)
	Ghana	1992-2019	ARDL	Negative influence	Asravor & Fonu (2020)
	India	2010-2020	VECM	No impact	Kuntamalla & Krishna (2022)

Note: OLS – method of least squares; VAR – vector autoregression model; ARDL autoregressive model with lag distribution; VECM – vector model with error correction

Source: Author

As can be seen from Table 1, regardless of whether it is about capital markets in developed or developing countries, as well as the research methodology used, different studies indicate different significance and impact of macroeconomic factors on the capital market, implying the necessity of studying this issue on a case-by-case basis. Interestingly, it should be noted that all authors in their research started from the perspectives formed based on the theoretical postulates of the Capital Asset Pricing Model, the Arbitrage Pricing Theory, and the Efficient Market Hypothesis, and there is no consensus among them regarding the most significant macroeconomic factors that affect the capital market. A characteristic of these studies is that they have not been able to identify all factors. One reason for this lies in the imperfections of econometric tools. The presence of endogeneity in some variables in econometric models has led to the omission of certain significant factors from the models. Another reason lies in the fact that there are a large number of unnoticed factors that influence market performance and are specific to individual countries.

The lack of a unified stance regarding the impact of different macroeconomic factors is a consequence of the use of different research methodologies. At the same time, it creates an imperative to study the impact on a case-by-case basis because existing research does not allow for a universal and definitive conclusion regarding the impact and significance of various macroeconomic factors on the capital market.

METHODOLOGY AND RESEARCH VARIABLES

The study on the impact of key macroeconomic factors on the capital market of the Republic of Serbia was conducted for the period from January 2007 to September 2021. The selected indicators of the macroeconomic factors used were the gross domestic product (GDP) growth rate, consumer price index, monetary aggregate M3, the reference interest rate of the National Bank of Serbia, and the foreign exchange rate EUR_RSD. The research covered the period from January 2007 to September 2021. A total of 177 monthly observations of independent variable values were used. Theoretically, a portfolio consisting of all long-term securities listed on the stock exchange would represent the best proxy for the capital market. Since it is impossible to construct such a portfolio and track its value changes, for the purposes of this study, the capital market of the Republic of Serbia was represented through the Belgrade Stock Exchange index Belex15, which represents the market index of the 15 most liquid stocks listed on the Belgrade Stock Exchange.

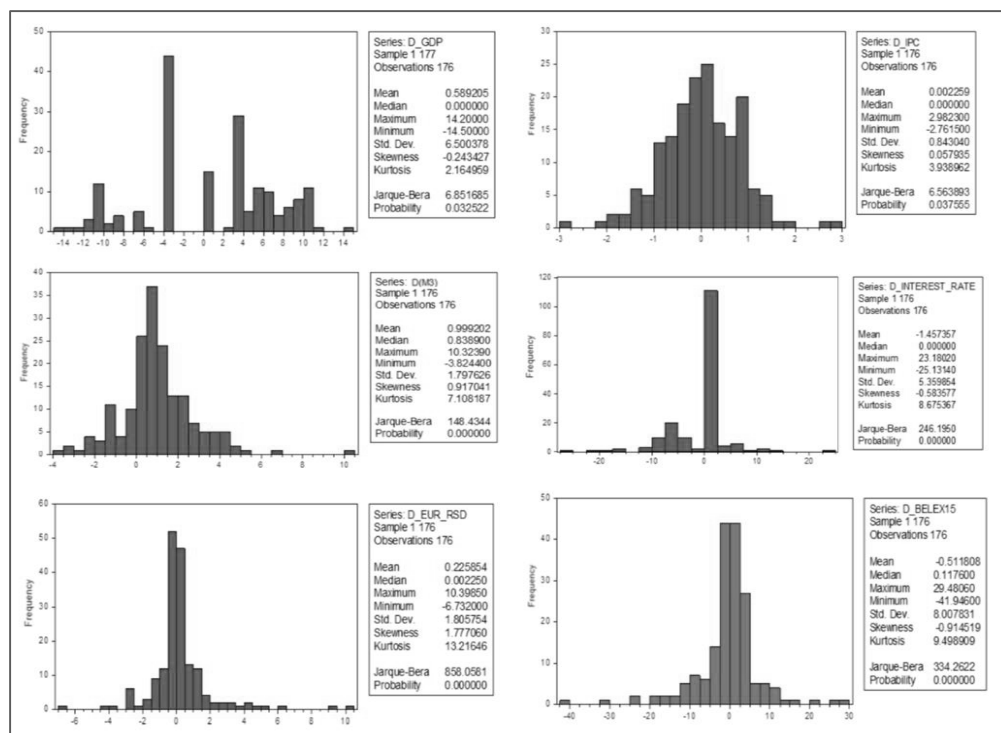
Since the first step in studying the impact of macroeconomic factors on the capital market involves examining the stationarity of the collected data, the hypothesis of stationarity was tested first. Testing the hypothesis of stationarity of the analyzed time series, i.e., analyzing the stabilization of the time series around its long-term mean, was performed using the appropriate form of the Augmented Dickey-Fuller Test. When conducting the ADF test to determine the lag length, the Schwarz criterion (SIC) will be used. The results of the research are presented in Table 2.

As seen from the table, all variables exhibited non-stationarity. For this reason, first-order differencing was performed. Specifically, the observed variable was transformed into a stationary form by taking the first difference. Afterward, an Augmented Dickey-Fuller (ADF) test for unit root will be conducted on the first-differenced logarithmic values. Table 2 also presents the results of the ADF test after the first differencing. The results indicate that all data series have become stationary.

Table 2. ADF test

Null Hypothesis: The variable has a unit root				1 st difference
Exogenous: Constant				
Lag Length: (Automatic - based on SIC, 13)				
Augmented Dickey-Fuller test statistic	lag	t-Statistic	Prob.*	Prob.*
GDP	12	1.108560	0.9975	0.000
ICP	3	0.034756	0.6926	0.000
M3	0	2.670235	1.0000	0.000
RIR	1	-1.020098	0.7458	0.000
EUR_RSD	0	-2.224566	0.1984	0.000
BELEX15	1	-2.822509	0.0572	0.000

Source: Autor's

Figure 1. Histogram of selected variables

Source: Autor's

Figure 1 displays histograms of the distribution of transformed variables along with their descriptive statistics. The results of the descriptive statistics indicate that the variables deviate from a normal distribution, which suggests instability in the macroeconomic variables. It is particularly important to note the skewness and kurtosis of the market index. The skewness value is -0.9145, indicating a left-skewed distribution, which implies a dominance of value loss in the index or a decline in the Serbian capital market. The kurtosis value is 9.498, indicating the presence of heavy tails in the distribution. These extreme values are the cause of leptokurtosis. Such a distribution of Belex15 suggests a higher probability of market decline rather than growth in the Serbian capital market. The descriptive analysis for the other variables indicates a higher probability of negative GDP and IRI growth, while the opposite is observed for IPC, M3, and exchange rates. Volatility analysis in the time series of selected macroeconomic variables reveals significant instability, which is not favourable for their impact on the capital market (Table 1A).

Considering that the second step in examining the impact of macroeconomic factors on the capital market involves investigating the existence of long-term relationships between the observed variables, the Johansen cointegration test was used in this study. The test was chosen because all variables have the same degree of integration. The optimal lag length was determined using five different criteria: sequential modified LR test (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). The results of applying these criteria are presented in Table 3.

In accordance with the obtained grades according to the five selection criteria used, 6 lags order were used in the paper, because this offset length minimizes 4 of the 5 criteria. The results of Johansen's cointegration rank test with 6 lag order are shown in Table 4, with a note that the Trace Statistic test was used to determine the cointegration rank.

Table 3. VAR Lag order selection criteria

Endogenous variables: BELEX15 GDP IPC M3 INTEREST_RATE EUR_RSD
 Exogenous variables: C
 Sample: 1 177
 Included observations: 171

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5442.655	NA	1.91e+20	63.72696	63.83719	63.77168
1	-4066.759	2639.145	2.99e+13	48.05566	48.82730	48.36876
2	-3996.613	129.6253	2.01e+13	47.65630	49.08934	48.39124
3	-3950.790	81.46395	1.80e+13	47.54140	49.63585	48.38853
4	-3891.613	101.0506	1.38e+13	47.27033	50.02617	48.50756
5	-3842.845	79.85471	1.20e+13	47.12099	50.53824	48.35045
6	-3770.466	113.4355*	8.00e+12*	46.69551*	50.77416	48.23776*

Source: Autor's

Table 4. Trace Statistic test

Sample (adjusted): 8 177
 Included observations: 170 after adjustments
 Trend assumption: Linear deterministic trend
 Series: BELEX15 GDP IPC M3 INTEREST_RATE EUR_RSD
 Lags interval (in first differences): 1 to 6
 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.368075	222.0852	95.75366	0.0000
At most 1 *	0.312697	144.0579	69.81889	0.0000
At most 2 *	0.232719	80.31130	47.85613	0.0000
At most 3 *	0.127270	35.27799	29.79707	0.0106
At most 4	0.043800	12.13597	15.49471	0.1505
At most 5 *	0.026249	4.521934	3.841466	0.0335

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

Source: Autor's

Based on the data presented in Table 4, it can be concluded that there are 4 cointegration vectors, meaning 4 long-term cointegrating relationships between the observed variables. The presence of cointegration indicates the

existence of long-term interconnectedness between the variables, suggesting a common long-term movement. The cointegration coefficients are shown in Table 5, with a note that they represent normalized cointegration coefficients.

Table 5. Cointegration coefficients

Unrestricted Cointegrating Coefficients (normalized by $b^*S11*b=1$):						
BELEX15	GDP	IPC	M3	INTEREST_	EUR_RSD	
0.002770	-0.386950	1.983356	2.48E-07	RATE	0.008809	
-0.002229	-0.493185	2.026622	3.17E-07	-0.169811	0.004672	
3.62E-05	-0.342035	-3.199577	1.87E-06	0.070218	-0.116743	
-0.000881	0.444641	0.372130	-2.25E-07	-0.524615	-0.072883	
-0.000353	-0.284100	-1.668901	-3.57E-06	-0.307088	0.056704	
0.003579	0.071796	0.055984	2.23E-06	0.589592	0.191412	
Unrestricted Adjustment Coefficients (alpha):						
D(BELEX15)	-14.59339	20.64762	-3.102174	3.288174	0.213647	4.431975
D(GDP)	1.820727	1.674169	0.800434	-0.427330	0.003978	-0.090961
D(IPC)	-0.038280	-0.095786	0.094254	0.057567	0.078258	-0.001050
D(M3)	2181.138	1486.780	4227.321	6216.946	-2601.004	-1157.258
D(INTEREST_	0.044374	0.022606	-0.111359	0.027560	0.038086	-0.024523
_RATE)						
D(EUR_RSD)	-0.388075	-0.075555	0.131706	0.001146	-0.018312	-0.173994
Log						
Cointegrating Equation(s): likelihood -3772.757						
Normalized cointegrating coefficients (standard error in parentheses)						
BELEX15	GDP	IPC	M3	INTEREST_RATE	EUR_RSD	
1.000000	-139.7039	716.0680	8.96E-05	-61.30842	3.180322	
	(36.6781)	(189.309)	(0.00017)	(30.1072)	(8.04412)	
Adjustment coefficients (standard error in parentheses)						
D(BELEX15)	-0.040421					
	(0.01230)					
D(GDP)	0.005043					
	(0.00106)					
D(IPC)	-0.000106					
	(0.00012)					
D(M3)	6.041288					
	(5.91106)					
D(INTEREST_RATE)	0.000123					
	(8.4E-05)					
D(EUR_RSD)	-0.001075					
	(0.00030)					

Source: Autor's

Based on the obtained coefficients, the following conclusions can be drawn:

- Gross Domestic Product (GDP) with a normalized cointegration coefficient of -139.7039 has a positive impact on Belex15.
- The Consumer Price Index (IPC) with a normalized cointegration coefficient of 716.0680 has a negative impact on Belex15.
- The money supply expressed through the M3 aggregate (M3) has a normalized cointegration coefficient of 8.96E-05, indicating a negative impact on Belex15.
- The reference interest rate of the National Bank of Serbia (Interest_rate) with a normalized cointegration coefficient of -61.30842 has a positive impact on Belex15.
- The foreign exchange rate EUR_RSD has a normalized cointegration coefficient of 3.180322 and a negative impact on Belex15.

These conclusions are consistent with the postulates of economic and financial theory:

- An increase in the gross domestic product leads to increased demand for financial assets, resulting in an increase in capital market prices, i.e., the value of the stock index, and vice versa, *ceteris paribus*.
- An increase in the consumer price index (inflation) reduces the demand for financial assets, leading to a decline in capital market prices, i.e., a decrease in the value of the stock index, and vice versa, *ceteris paribus*.
- An increase in the money supply, in the long run, reduces the demand for financial assets, leading to a decline in capital market prices, i.e., a decrease in the value of the stock index, and vice versa, *ceteris paribus*.
- Lower interest rates stimulate economic activity, and increase the demand for financial instruments, leading to economic expansion and an increase in the value of the stock index, and vice versa, *ceteris paribus*.
- An increase in the foreign exchange rate EUR_RSD, i.e., a depreciation of the local currency, reduces the demand for domestic financial assets, leading to a decline in capital market prices, i.e., a

decrease in the value of the stock index, and vice versa, *ceteris paribus*.

In Table 6, the values of t-statistics are presented as the ratio of the normalized cointegration coefficient and the standard error (given in parentheses).

Table 6. *Normalized values of cointegration coefficients for five independent variables*

Normalized cointegrating coefficients (standard error in parentheses)					
BELEX15	GDP	IPC	M3	INTEREST_RATE	EUR_RSD
1.000	-139.7039	716.0680	8.96E-05	-61.30842	3.180322
	(36.6781)	(189.309)	(0.00017)	(30.1072)	(8.04412)
t-stat.	-3.8098	3.7825	0.5271	-2.0363	0.3953

Source: Autor's

Based on the obtained t-statistics, the null hypothesis was tested: in the analyzed time series, there is no cointegration, compared to the alternative hypothesis: the analyzed time series possesses a cointegrating relationship. Since the obtained t-statistic value is greater than 2 in absolute value for gross domestic product (GDP), the consumer price index (IPC), and the reference interest rate of the National Bank of Serbia, the normalized cointegration coefficients for these three independent macroeconomic variables are statistically significant at a 1% confidence level. The results indicate the presence of long-term relationships between the variables of gross domestic product, the consumer price index, the reference interest rate of the National Bank of Serbia, and the value of the domestic capital market index, Belex15.

The presence of cointegration vectors precludes the application of the classical linear regression model when analyzing the observed variables, instead, the Vector Error Correction Model (VECM) is considered appropriate. The results of applying VECM are shown in Table 2A in the paper attachment. The obtained results of VECM indicate that Belex15(-1), GDP(-1), IPC(-1), and M3(-1) do not show a significant coefficient of association with CointEq1, CointEq2, CointEq3, or CointEq4. INTEREST_RATE(-1) and EUR_RSD(-1) have significant coefficients of association with CointEq1, CointEq2, CointEq3, and CointEq4. The analysis of error correction coefficients indicates that changes in Belex15

(D(BELEX15)) have a significant negative coefficient of association with CointEq1, while other changes (D(GDP), D(IPC), D(M3), D(INTEREST_RATE), D(EUR_RSD)) do not have a significant coefficient of association with CointEq1. Other changes have different coefficients of association with CointEq2, CointEq3, and CointEq4, but they are not significant for the Belex15 index. Coefficients D(BELEX15(-1)), D(BELEX15(-2)), D(BELEX15(-3)), D(BELEX15(-4)), and D(BELEX15(-5)): D(BELEX15(-1)) has a significant positive coefficient of association with D(BELEX15(-1)) and a significant negative coefficient of association with D(INTEREST_RATE). D(BELEX15(-2)) has a negative coefficient of association with D(BELEX15(-1)) and a positive coefficient of association with D(EUR_RSD). D(BELEX15(-3)), D(BELEX15(-4)), and D(BELEX15(-5)) also have different coefficients of association with previous changes, but none are significant for the Belex15 index.

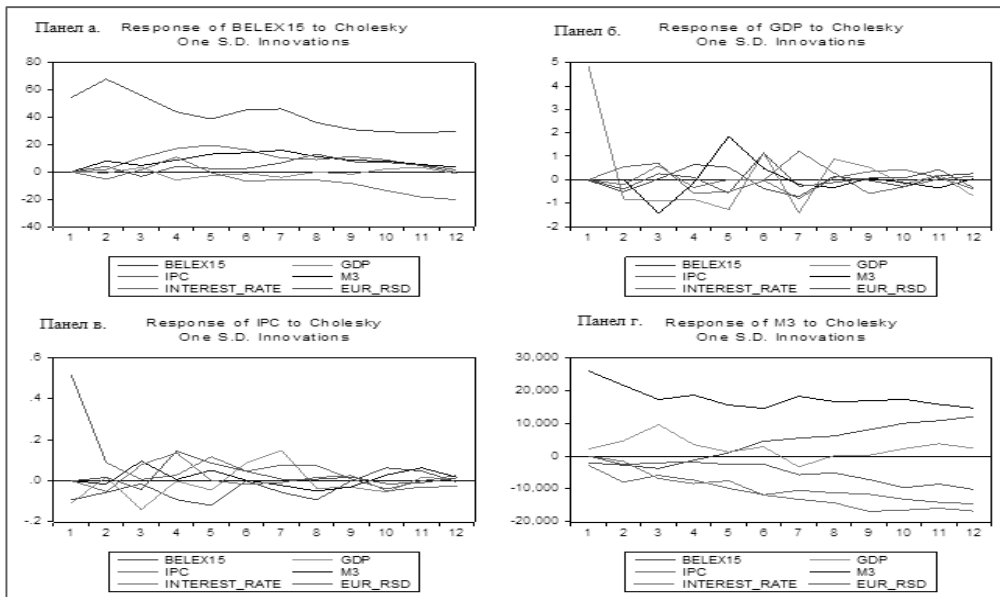
In summary, analyzing the presented data, we can conclude that INTEREST_RATE(-1) and EUR_RSD(-1) are significant factors associated with the Cointegrating Equation and change in the Belex15 index have some relationships with previous changes and the interest rate (INTEREST_RATE), but they are not significant with other economic indicators such as GDP, IPC, and M3. More precisely, the Belex15 index does not exhibit long-term cointegration with GDP, IPC, and M3. However, there is a significant influence of previous interest rate values (INTEREST_RATE(-1)) and exchange rate (EUR_RSD(-1)) on the Belex15 index. A positive coefficient for INTEREST_RATE(-1) indicates that an increase in the previous period's interest rate tends to impact the growth of the Belex15 index. A negative coefficient for EUR_RSD(-1) suggests that depreciation of the dinar against the euro tends to affect the decline of the capital market in the Republic of Serbia.

The analysis of the Impulse Response Function shown in Figure 2 enables a better understanding of the impact of macroeconomic factors on the capital market and vice versa, as it represents an efficient statistical tool for analyzing the effects of shocks or impulses on the variable of interest in a time series model. It provides insight into how the variable changes over time in response to a one-time shock in another variable, assuming that all other variables remain constant. In Figure 2, the rates of change of one variable caused by changes in another variable are shown according to the Cholesky decomposition,

applying an innovation of one standard deviation over a 12-month period. It should be noted that the variables are cross-examined. On the other hand, Figure 3 shows the rate of change of the dependent variable caused by changes in another independent variable according to the Cholesky decomposition, applying an innovation of one standard deviation.

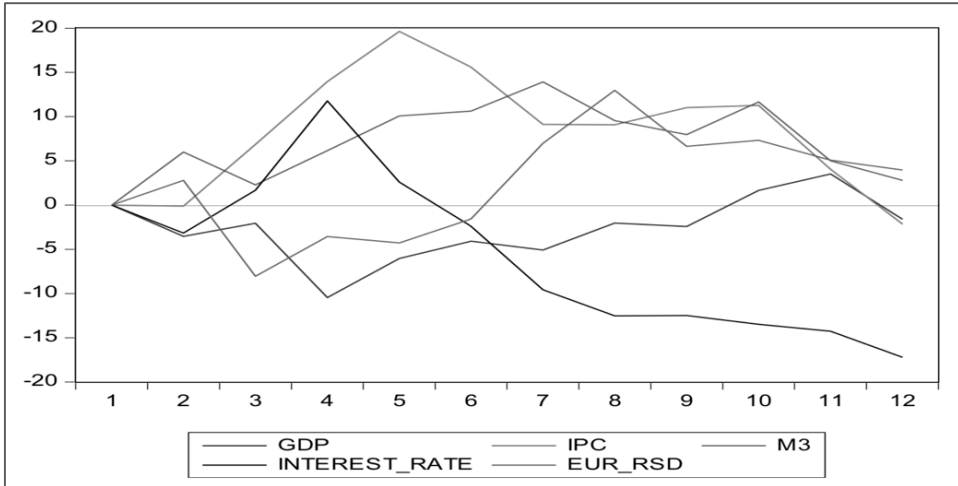
Based on the presented results of the analysis in Figure 2, the following conclusions can be drawn: The Impulse Response Function for Belex15 (panel a), Gross Domestic Product (panel b), and Consumer Price Index (panel v) as independent variables have values closest to zero at the end of the observed period, indicating that the effect of the shock is not permanent.²⁾ The Impulse Response Function for Money Supply M3 (panel g), Nominal Interest Rate of the National Bank of Serbia (panel d), and Exchange Rate EUR/RSD (panel h) as independent variables have values at the end of the observed period that are significantly different from zero, indicating that the effect of the shock is persistent in the longer term.

Figure 2. *The rate of change of a variable caused by changes in another variable according to the Cholesky decomposition, applying an innovation of one standard deviation over period of 12 months*



Source: Autor's

Figure 3. *The rate of change of the dependent variable caused by changes in the second independent variable according to Cholesky, applying an innovation in the value of one standard deviation in a period of 12 months*



Source: Autor's

Based on the analysis results shown in Figure 3, the following can be concluded:

- The Impulse Response Function of Gross Domestic Product (GDP) shows that Belex15 initially experiences a decline, followed by an increase and eventually converges to a value close to zero, indicating that the shock effect is not permanent.
- The response of Belex15 to the impulse of the Consumer Price Index (CPI) initially shows a longer period of strong growth, followed by a decline and a movement towards zero, indicating that the shock effect is not permanent.
- The response of Belex15 to the impulse of Money Supply M3 initially shows a positive response, followed by a decline, a longer period of growth, and a slight decline that does not stop close to zero, indicating that the shock effect is permanent.
- The response of Belex15 to the impulse of the reference interest rate of the National Bank of Serbia (NBS) initially reacts with a decline, followed by more intense growth and a drastic decline. At the end of

the observed one-year period, the response is significantly below zero, indicating that the shock effect is permanent.

By extending the time period of observation, the response of Belex15 to changes in the independent variables converges to zero, indicating that the shock effect diminishes and slowly loses its permanence.

CONCLUSION

This paper examined the impact of five macroeconomic factors on the capital market of the Republic of Serbia. The focus was on gross domestic product (GDP), inflation, interest rates, money supply, and exchange rates. These macroeconomic factors were chosen for study because they have been highlighted as significant in numerous works related to capital market development. However, conflicting findings among different authors hinder the ability to draw a universal conclusion regarding the direction of their influence. The selected macroeconomic factors were represented by appropriate indicators such as GDP growth rate, IPC, M3, the reference interest rate of the National Bank of Serbia, and the exchange rate of the euro against the dinar. The capital market was expressed through the Belex15 index. The research results show that the Belex15 index does not exhibit long-term cointegration with GDP, IPC, and M3. However, there is a significant influence of previous interest rate values ($INTEREST_RATE(-1)$) and the exchange rate ($EUR_RSD(-1)$) on the Belex15 index. A positive coefficient for $INTEREST_RATE(-1)$ indicates that an increase in the previous period's interest rate tends to impact the growth of the Belex15 index. A negative coefficient for $EUR_RSD(-1)$ suggests that depreciation of the dinar against the euro tends to affect the decline of the capital market in the Republic of Serbia. The research results also show that shocks in gross domestic product do not have a permanent impact on the capital market of the Republic of Serbia, nor does inflation. However, changes in the money supply have a permanent impact, as well as shocks in interest rates and exchange rates. These findings are highly significant from the perspective of monetary policy makers. Identifying the reasons why some of the selected factors have a significant impact on the capital market of the Republic of Serbia while others do not should be the subject of further analysis. This requires a more in-depth analysis, starting from market participants, their behavior, trading structure, and the influence of legal solutions on their behavior and other macroeconomic factors.

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UTICAJ MAKROEKONOMSKIH FAKTORA NA TRŽIŠTE KAPITALA REPUBLIKE SRBIJE

Vesna Marić

Svetlana Ignjatijević

Sažetak: U ovom radu vršeno je istraživanje uticaja pet makroekonomskih faktora na tržište kapitala Republike Srbije. Fokus je bio na faktorima koji su identifikovani kao značajni i koji imaju uticaj na razvoj tržišta kapitala, ali sa različitih aspekata koji se dovode u vezu sa smerom uticaja. Izvršeno je istraživanje sledećih faktora: GDP, inflacija, količina novca u opticaju, kamatna stopa i devizni kurs. Rezultati istraživanja pokazuju da indeks Belex 15 ne pokazuje dugoročnu kointegraciju sa sledećim faktorima: GDP, inflacija i M3 (količina novca u opticaju). Od faktora koji su bili predmet

istraživanja, značajan uticaj na tržište kapitala Republike Srbije ostvaruju kamatna stopa, koja ima pozitivan uticaj i devizni kurs, gde je zabeležen negativan uticaj.

Ključne reči: makroekonomski faktori / tržište kapitala / kointegracija / VECM / Johansen - ov test kointegracije.

Appendix

Table 1A. Heteroskedasticity Test

Heteroskedasticity Test: ARCH
 Dependent Variable: RESID^2
 Method: Least Squares
 Sample (adjusted): 2 176
 Included observations: 175 after adjustments

GDP	F-statistic	16.43891	Prob. F(1,173)	0.0001
	Obs*R-squared	15.18595	Prob. Chi-Square(1)	0.0001
IPC	F-statistic	2.441038	Prob. F(1,173)	0.1200
	Obs*R-squared	2.434902	Prob. Chi-Square(1)	0.1187
M3	F-statistic	0.388679	Prob. F(1,173)	0.4338
	Obs*R-squared	0.392291	Prob. Chi-Square(1)	0.4311
INTEREST_RATE	F-statistic	6.591888	Prob. F(1,173)	0.0111
	Obs*R-squared	6.423344	Prob. Chi-Square(1)	0.0113
EUR_RSD	F-statistic	16.20099	Prob. F(1,173)	0.0001
	Obs*R-squared	14.98498	Prob. Chi-Square(1)	0.0001
USE_RSD	F-statistic	0.251735	Prob. F(1,173)	0.04661
	Obs*R-squared	0.254275	Prob. Chi-Square(1)	0.04616
Belex15	F-statistic	27.17942	Prob. F(1,173)	0.0000
	Obs*R-squared	23.76068	Prob. Chi-Square(1)	0.0000

Source: Autor's

Table 2A. VECM results

Vector Error Correction Estimates

Sample (adjusted): 7 177

Included observations: 171 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4		
BELEX15(-1)	1.000000	0.000000	0.000000	0.000000		
GDP(-1)	0.000000	1.000000	0.000000	0.000000		
IPC(-1)	0.000000	0.000000	1.000000	0.000000		
M3(-1)	0.000000	0.000000	0.000000	1.000000		
INTEREST_RATE(-1)	114.7656 (27.8660) [4.11848]	-0.536340 (0.12907) [-4.15539]	-0.261545 (0.05016) [-5.21377]	-605936.2 (130607.) [-4.63940]		
EUR_RSD(-1)	26.05416 (8.34533) [3.12201]	-0.087377 (0.03865) [-2.26048]	-0.026557 (0.01502) [-1.76770]	-144844.6 (39114.1) [-3.70313]		
C	-4514.857	13.06638	-95.53009	18619919		
Error Correction:	D (BELEX15)	D(GDP)	D(IPC)	D(M3)	D(INTERE ST_RATE)	D(EUR_RSD)
CointEq1	-0.081976 (0.01331) [-6.15800]	0.000735 (0.00118) [0.62147]	-8.47E-05 (0.00013) [-0.64461]	-5.700733 (6.44509) [-0.88451]	7.57E-05 (9.3E-05) [0.81075]	-0.000947 (0.00035) [-2.70881]
CointEq2	0.391276 (2.81957) [0.13877]	-2.332166 (0.25065) [-9.30451]	0.026524 (0.02783) [0.95315]	-977.5588 (1365.10) [-0.71611]	0.021600 (0.01978) [1.09181]	0.012120 (0.07405) [0.16368]
CointEq3	18.48855 (15.8423) [1.16703]	2.697709 (1.40832) [1.91555]	-0.404762 (0.15636) [-2.58871]	-4122.866 (7670.12) [-0.53752]	0.363827 (0.11116) [3.27297]	-1.084475 (0.41606) [-2.60653]
CointEq4	-1.89E-05 (6.5E-06) [-2.92241]	1.03E-06 (5.7E-07) [1.79384]	1.50E-07 (6.4E-08) [2.35303]	0.008049 (0.00313) [2.57559]	-1.18E-07 (4.5E-08) [-2.59660]	2.09E-07 (1.7E-07) [1.23015]
D(BELEX15(-1))	0.371826 (0.07932) [4.68761]	-0.012170 (0.00705) [-1.72592]	-0.000675 (0.00078) [-0.86223]	-54.87689 (38.4035) [-1.42895]	-0.001990 (0.00056) [-3.57594]	-0.009373 (0.00208) [-4.49949]
D(BELEX15(-2))	-0.217167 (0.07809) [-2.78102]	0.001331 (0.00694) [0.19170]	5.57E-05 (0.00077) [0.07232]	-45.90473 (37.8071) [-1.21418]	0.000882 (0.00055) [1.60945]	-0.001347 (0.00205) [-0.65700]
D(BELEX15(-3))	0.155099 (0.06712) [2.31089]	0.005830 (0.00597) [0.97717]	-8.95E-05 (0.00066) [-0.13505]	8.625283 (32.4947) [0.26544]	-0.000723 (0.00047) [-1.53441]	-0.003859 (0.00176) [-2.18948]
D(BELEX15(-4))	-0.014977 (0.06088)	-0.003516 (0.00541)	0.000883 (0.00060)	-20.08397 (29.4773)	0.000416 (0.00043)	-0.001305 (0.00160)

	[-0.24599]	[-0.64967]	[1.46899]	[-0.68134]	[0.97381]	[-0.81594]
D(BELEX15(-5))	0.174704	-4.51E-05	0.001684	34.64040	3.80E-06	0.003462
	(0.05654)	(0.00503)	(0.00056)	(27.3735)	(0.00040)	(0.00148)
	[3.08997]	[-0.00897]	[3.01811]	[1.26547]	[0.00959]	[2.33175]
D(GDP(-1))	-0.431510	1.167691	-0.018471	1199.359	-0.027134	-0.006764
	(2.55103)	(0.22678)	(0.02518)	(1235.09)	(0.01790)	(0.06700)
	[-0.16915]	[5.14908]	[-0.73363]	[0.97107]	[-1.51587]	[-0.10096]
D(GDP(-2))	0.315068	1.004597	-0.050715	2521.397	-0.026547	0.000966
	(2.18834)	(0.19454)	(0.02160)	(1059.49)	(0.01535)	(0.05747)
	[0.14398]	[5.16409]	[-2.34816]	[2.37982]	[-1.72892]	[0.01681]
D(GDP(-3))	-1.104457	0.818616	-0.038581	1243.362	-0.023996	0.041161
	(1.77577)	(0.15786)	(0.01753)	(859.743)	(0.01246)	(0.04664)
	[-0.62196]	[5.18575]	[-2.20136]	[1.44620]	[-1.92581]	[0.88259]
D(GDP(-4))	0.565384	0.494370	-0.051712	1073.833	-0.014361	0.030232
	(1.24932)	(0.11106)	(0.01233)	(604.860)	(0.00877)	(0.03281)
	[0.45255]	[4.45140]	[-4.19394]	[1.77534]	[-1.63819]	[0.92141]
D(GDP(-5))	0.257337	0.514812	-0.022089	848.4798	-0.004002	-0.002255
	(0.88387)	(0.07857)	(0.00872)	(427.930)	(0.00620)	(0.02321)
	[0.29115]	[6.55202]	[-2.53219]	[1.98275]	[-0.64527]	[-0.09714]
D(IPC(-1))	-12.04089	-1.556680	-0.412898	-6197.599	-0.311320	0.557731
	(16.1566)	(1.43626)	(0.15946)	(7822.26)	(0.11337)	(0.42431)
	[-0.74526]	[-1.08384]	[-2.58938]	[-0.79230]	[-2.74615]	[1.31443]
D(IPC(-2))	4.355072	-0.740975	-0.436791	-1895.602	-0.228957	0.765049
	(14.9655)	(1.33038)	(0.14770)	(7245.60)	(0.10501)	(0.39303)
	[0.29101]	[-0.55697]	[-2.95723]	[-0.26162]	[-2.18036]	[1.94653]
D(IPC(-3))	3.704322	-1.950933	-0.348912	-5272.106	-0.181607	0.640612
	(12.9027)	(1.14700)	(0.12734)	(6246.90)	(0.09053)	(0.33886)
	[0.28710]	[-1.70090]	[-2.73991]	[-0.84396]	[-2.00594]	[1.89050]
D(IPC(-4))	20.47343	-2.375354	-0.090623	-6514.019	-0.048966	0.139792
	(10.8390)	(0.96355)	(0.10698)	(5247.76)	(0.07605)	(0.28466)
	[1.88886]	[-2.46521]	[-0.84713]	[-1.24129]	[-0.64383]	[0.49108]
D(IPC(-5))	12.16720	-2.026038	-0.076163	-4513.036	0.014795	0.138735
	(8.28650)	(0.73664)	(0.08178)	(4011.94)	(0.05814)	(0.21762)
	[1.46832]	[-2.75038]	[-0.93127]	[-1.12490]	[0.25445]	[0.63750]
D(M3(-1))	0.000238	4.20E-06	-1.30E-06	-0.148973	2.27E-06	-3.42E-06
	(0.00019)	(1.7E-05)	(1.9E-06)	(0.09234)	(1.3E-06)	(5.0E-06)
	[1.24628]	[0.24755]	[-0.69214]	[-1.61340]	[1.69669]	[-0.68223]
D(M3(-2))	5.82E-05	-5.17E-05	5.15E-06	-0.230505	1.16E-06	-1.19E-06
	(0.00019)	(1.7E-05)	(1.9E-06)	(0.09302)	(1.3E-06)	(5.0E-06)
	[0.30270]	[-3.02459]	[2.71807]	[-2.47789]	[0.85721]	[-0.23558]
D(M3(-3))	0.000137	-3.21E-05	-1.59E-06	0.079220	6.47E-07	1.02E-06
	(0.00020)	(1.8E-05)	(2.0E-06)	(0.09600)	(1.4E-06)	(5.2E-06)
	[0.69099]	[-1.82231]	[-0.81111]	[0.82524]	[0.46511]	[0.19575]
D(M3(-4))	9.28E-05	5.05E-05	6.73E-08	-0.076667	-4.19E-07	-5.07E-06
	(0.00019)	(1.7E-05)	(1.9E-06)	(0.09271)	(1.3E-06)	(5.0E-06)
	[0.48464]	[2.96597]	[0.03563]	[-0.82698]	[-0.31203]	[-1.00910]
D(M3(-5))	9.60E-05	1.25E-05	-1.95E-06	-0.102934	5.90E-07	3.75E-06
	(0.00018)	(1.6E-05)	(1.8E-06)	(0.08767)	(1.3E-06)	(4.8E-06)
	[0.52997]	[0.77832]	[-1.09295]	[-1.17405]	[0.46440]	[0.78850]

D(INTEREST_RATE(-1))	-13.16320	-0.410399	-0.139008	575.7931	0.309348	-0.033005
	(12.3149)	(1.09475)	(0.12154)	(5962.30)	(0.08641)	(0.32342)
	[-1.06888]	[-0.37488]	[-1.14369]	[0.09657]	[3.58000]	[-0.10205]
D(INTEREST_RATE(-2))	35.86842	1.548237	0.292689	-12393.93	0.022248	-0.565037
	(12.6176)	(1.12165)	(0.12453)	(6108.83)	(0.08853)	(0.33137)
	[2.84274]	[1.38032]	[2.35036]	[-2.02886]	[0.25129]	[-1.70516]
D(INTEREST_RATE(-3))	11.74015	-1.204065	0.206199	5019.076	0.141002	0.224919
	(12.1861)	(1.08329)	(0.12027)	(5899.92)	(0.08551)	(0.32004)
	[0.96341]	[-1.11148]	[1.71445]	[0.85070]	[1.64903]	[0.70279]
D(INTEREST_RATE(-4))	-37.72447	-0.757463	-0.002290	6173.552	-0.090187	-0.296854
	(11.9720)	(1.06426)	(0.11816)	(5796.26)	(0.08400)	(0.31441)
	[-3.15107]	[-0.71173]	[-0.01938]	[1.06509]	[-1.07360]	[-0.94415]
D(INTEREST_RATE(-5))	12.07103	-1.510451	-0.087582	-8249.205	0.070122	-0.543778
	(11.9120)	(1.05893)	(0.11757)	(5767.25)	(0.08358)	(0.31284)
	[1.01335]	[-1.42639]	[-0.74496]	[-1.43035]	[0.83895]	[-1.73820]
D(EUR_RSD(-1))	3.333805	-0.338463	0.028803	-989.4546	0.021757	-0.314192
	(3.62044)	(0.32184)	(0.03573)	(1752.85)	(0.02540)	(0.09508)
	[0.92083]	[-1.05164]	[0.80609]	[-0.56448]	[0.85647]	[-3.30444]
D(EUR_RSD(-2))	-5.246561	0.092878	-0.011076	1037.191	0.008576	0.013073
	(3.54407)	(0.31505)	(0.03498)	(1715.87)	(0.02487)	(0.09308)
	[-1.48038]	[0.29480]	[-0.31667]	[0.60447]	[0.34488]	[0.14046]
D(EUR_RSD(-3))	6.374759	-0.079823	0.120681	1278.087	-0.058011	0.101587
	(3.19298)	(0.28384)	(0.03151)	(1545.89)	(0.02240)	(0.08386)
	[1.99649]	[-0.28122]	[3.82952]	[0.82676]	[-2.58931]	[1.21145]
D(EUR_RSD(-4))	-4.964244	-0.550811	0.096049	1827.483	0.068983	0.154669
	(3.36158)	(0.29883)	(0.03318)	(1627.52)	(0.02359)	(0.08828)
	[-1.47676]	[-1.84321]	[2.89503]	[1.12286]	[2.92460]	[1.75196]
D(EUR_RSD(-5))	3.754381	0.638913	0.083923	1144.426	-0.022385	-0.118280
	(3.46458)	(0.30799)	(0.03419)	(1677.39)	(0.02431)	(0.09099)
	[1.08365]	[2.07447]	[2.45432]	[0.68227]	[-0.92082]	[-1.29994]
C	-18.64191	0.048525	-0.047084	22232.08	-0.119661	0.104155
	(8.85523)	(0.78720)	(0.08740)	(4287.29)	(0.06213)	(0.23256)
	[-2.10519]	[0.06164]	[-0.53873]	[5.18558]	[-1.92584]	[0.44786]
R-squared	0.581112	0.804315	0.676035	0.407182	0.488726	0.408346
Adj. R-squared	0.476390	0.755394	0.595044	0.258977	0.360907	0.260432
Sum sq. resids	401959.5	3176.500	39.15411	9.42E+10	19.79014	277.2404
S.E. equation	54.36529	4.832868	0.536561	26321.13	0.381465	1.427772
F-statistic	5.549098	16.44106	8.347010	2.747428	3.823589	2.760704
Mean dependent	-11.88719	-1.30E-16	0.002339	16990.89	-0.049708	0.225346
S.D. dependent	75.13078	9.771734	0.843170	30576.57	0.477170	1.660236
Determinant resid covariance (dof: 2.43E+12)						
Determinant resid covariance		6.16E+11				
Log likelihood		-3776.848				
Akaike information criterion		46.91050				
Schwarz criterion		51.20962				

Source: Autor's