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**ANALYSIS OF FACTORS AFFECTING THE VELOCITY OF  
MONEY IN SERBIA**

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***Abstract:** The effect of money supply in the economy depends on the amount of money in circulation and the velocity of money. The velocity of money is not a constant value, as many researchers in their research consider and many factors affect the changing of velocity of money. In this paper we analyzed some of the factors influencing the change of velocity of money circulation in Serbia in the period 2000 - 2016 using multiple regression analysis. It was found that changes in the exchange rate, savings, discount rate and the level of monetization have a statistically significant impact on the change in value of the velocity of money circulation.*

***Keywords:** Velocity of Money, Regression Analysis, Serbia.*

**1. Introduction**

The velocity of money is the ratio of nominal GDP and money supply in one year. It can be defined as the number of times one monetary unit is involved in carrying out transactions in a given period of time. The velocity of money is a very important component in the monetary economy, because it affects the amount of money that is required to be in circulation in order to smooth transactions take place in the economy. However it should be noted that this indicator is rather generalized, and as such it unsafe for the conduct of monetary policy. Many studies and researches is of the opinion that the velocity of money is constant, which is a weakness because they misrepresented the views of the quantity theory of money. In fact, even the researchers who first have studied this issue have not taken as an assumption that the value is constant (Humphrey, 1993). It is rather variable size influenced by numerous factors. According to Djurovic Todorovic factors can be divided into:

- cyclical fluctuations in the economy
- variations in the monetary economy
- institutional changes in the financial system (Djurovic Todorovic, 2014, pp.314)

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Monetary theory has so far differentiated few basic factors affecting the velocity of money:

- designated restrictions in spending available funds
- technique payment system
- decentralization or centralization of funds
- the level of security in terms of income by economic agents
- psychological factor
- frequency of payments linked to the distribution of the gross domestic product
- greater or less economic stability (higher or lower inflation)
- political stability (Komazec & Ristić, 2012, pp. 151- 152)

In addition to these there are other factors the researchers examined, and some of which will be considered in this paper:

- interest rates
- changes in expected inflation
- changes in the structure of production and income distribution
- population structure
- the introduction of substitute money
- compensation arrangements
- high propensity to investment
- reducing the demand for currency by the population
- changes in habits payments
- structure of money supply
- degree of monetization
- the level of savings

The aim of this study was to analyze the factors affecting the change in velocity of money in Serbia using qualitative analysis and multiple linear regression.

## **2. Review of modern research**

The velocity of money today occupies an important place in research. Economists addition to the analysis of the dynamics, trends and factors affecting the velocity of money, research how velocity of money affects the macroeconomic indicators such as inflation and GDP. There are papers that apply statistical physics to describe the characteristics of the distribution of money and new models for the calculation of the velocity of circulation of money like Wang Y., Ding N and Zhang L (2003) and Xiong W., Fu H. and Wang Y. (2017).

In the case of Bangladesh in their paper by Alam S., Golam M. and Arf I. (2014) have tried to carry out verification of application of the quantity theory of money. One of the elements that have been analyzed is the velocity of money, for period 1989 - 2013, which had decreasing trend. The reason for the decline in the velocity of money for 73.15% is in increase in the quantity of money in circulation, ie. M2 monetary aggregate. They also found that although the percentage is decreasing is more than 70% for the reference period, the average value of 3.32% is very small and that in short term economy of Bangladesh can not be described with classical quantity theory of money.

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Hassan Shirvani and Barry Wilbratte (2008) were concerned with the analysis of the determinants of the velocity of circulation of money in the long and short term the case of France, Germany, Japan, UK and the USA, for the period 1978 - 1998 years on a quarterly basis. VAR analysis has been applied to analyse elements which are long-term trends and short-term trend determined. In the long term interest rates, wealth and oil prices have affect, while the short-term impact of the financial shocks from other countries. They showed that the velocity of money can be a stable and predictable variable in the long and short term, with the recommendation that holders of monetary policy should take into account the short-term shocks that may influence decision-making, primarily from other major countries in the world.

In the case of Kenya Ng'imor B.P. and Muthoga S. (2015) have performed an analysis of the impact of financial development on income velocity of money. They applied the ARDL model and found that financial development and innovation influence the change in velocity of money because they reduce the level of use of liquid forms of money for payment. They also found that GDP has a positive effect, while exchange rate negatively influence on the velocity of money circulation. In the example of the Philippines authors found that the variability in the rate of growth of money supply is positive with decreasing speed of money for the narrowly defined monetary aggregates (Baunto, et al, 2011). In the case of Pakistan Muhammad Omer (2010) also worked analysis of velocity of money circulation. The paper established function for velocity of money for all three monetary aggregates and found that there is a stable relationship between the determinants.

In the case of Ukraine it was found that the greatest impact on the change in velocity of money has changes in real wealth of the population. It was found that the increase in wealth has contributed to the decline in the velocity of money, while inflation has no statistically significant effect on the change in velocity of money (Sypotan, 2012).

Gaurang Rami (2010) analyzed the function of the velocity of circulation of money in India where he concluded that the velocity of M3 aggregate can be predicted, confirming monetarist stance. In his analysis he used several factors, such as real income, short-term interest rates, population per branch banks and monetary assets share in gross domestic savings and monetary aggregate. He showed that this model can describe 98% change in velocity of circulation of M3 aggregate.

The issue of the factors that affect the speed of circulation in Serbia Djordje Dubovina dealt with in his paper from 2016. He analyzed the impact of interest rates, unemployment, savings, foreign exchange rate at the speed of circulation in Serbia. It found that there is a downward trend in the velocity of money, which is mostly due to faster growth of the money supply from GDP.

### **3. Regression analysis of the factors influencing the change of velocity of money circulation in Serbia**

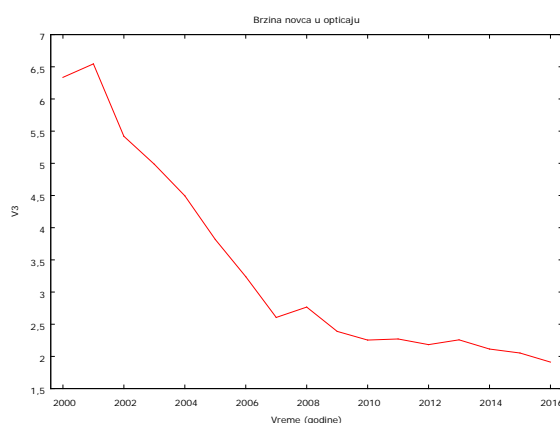
In this paper will be determined influence of following factors on change of velocity of money in Serbia: M3 monetary aggregate, GDP, discount rate, unemployment, exchange rate, coefficient of monetization and the level of savings.

By definition, the velocity of money is calculated as the ratio of nominal GDP value and the value of money in circulation. Depending on the observed monetary aggregates will depend the velocity of money in circulation. In our case, we consider the

broadest monetary aggregate, M3 and Graph 1 shows the dynamics of the velocity of money in circulation.

Based on the graphic 1, as in most countries in the world, in Serbia there is a downward trend in the velocity of money, which is dramaticall in the period from 2001 to 2007, and after that had the character of a slight decline by 2016. This can be explained by faster growth of the money supply in relation to the GDP growth for the observed period.

**Graph 1. Velocity of Money in Serbia 2000 - 2016**



Source: Data used from NBS, processing done by author

### 3.1. Regression analysis

For the purpose of regression analysis, the data related to the velocity of M3 monetary aggregate, level of monetization, the exchange rate, the discount rate, the number of unemployed persons, net income and savings. For the parameters of the velocity of money and the level of monetization, the data was obtained as follows: the velocity of money is GDP in current prices divided by the amount of M3 aggregate, while the degree of monetization is value of bank assets in Serbia divided by GDP in current prices. The data were obtained from the website of the National Bank of Serbia in the period 2000 - 2016. The analysis was performed in the program Gretl.

Prior to the regression analysis is necessary to determine the stationarity of all data that will be included in the model. KPSS test was used and obtained results are presented in Table 1. In KPSS test the null hypothesis is that the variable is stationary, so that the variable could be stationary p-value must be greater than 0.05, which makes it possible to confirm the null hypothesis.

**Table 1. KPSS Unit Root test**

Variable	p-value	Order
V3	<0.01	I(1)
d(V3)	>0.10	I(0)

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Income	<0.01	I(1)
d(Income)	>0.10	I(0)
Unemployed	0.023	I(1)
d(Unemployed)	0.083	I(0)
Saving	<0.01	I(1)
d(Saving)	>0.10	I(0)
Monetization	>0.10	I(0)
Exchangerate	<0.01	I(1)
d(Exchangerate)	>0.10	I(0)
Discountrate	0.023	I(1)
d(Discountrate)	0.083	I(0)

*Source:* Data processing done by author

On the basis of the values we see that all the parameters in their absolute values other than the degree of monetization are not stationary. Therefore, in the analysis were to take their first differences and found to meet the requirements of stationarity based on the KPSS test.

On the following model was based multiple regression analysis:

$$d(V3) = \alpha + \beta_1 d(\text{Income})_t + \beta_2 d(\text{Unemployed})_t + \beta_3 d(\text{Saving})_t + \beta_4 d(\text{Exchagerate})_t + \beta_5 d(\text{Discountrate})_t + \beta_6 \text{Monetization}_t + \varepsilon_t \quad (1)$$

In Table 2 are shown obtained values for the observed parameters:

**Table 2. The values of the parameters of the regression model**

Variable	Value	Error	p-value
const	-1.26363	0.138081	7.45e-06***
d(Income)	1.25295e-05	1.67819e-05	0.04744
d(Unemployed)	0.000431338	0.000586768	0.4810
d(Saving)	-5.91374e-06	8.65136e-07	7.59e-05***
d(Exchagerate)	0.0223214	0.00691577	0.0104**
d(Discountrate)	0.0595685	0.0137706	0.0019***
Monetization	1.87647	0.161481	1.01e-06***
Mean dependent var	-0.276505	S.D. dependent var	0.361060
Sum squared resid	0.107543	S.E. of regression	0.109312
R-squared	0.945004	Adjusted R-squared	0.908340
F(6, 9)	25.77477	P-value(F)	0.000035
Log-likelihood	17.31664	Akaike criterion	-20.63328
Schwarz criterion	-15.22516	Hannan-Quinn	-20.35634
rho	-0.125519	Durbin-Watson	2.020879

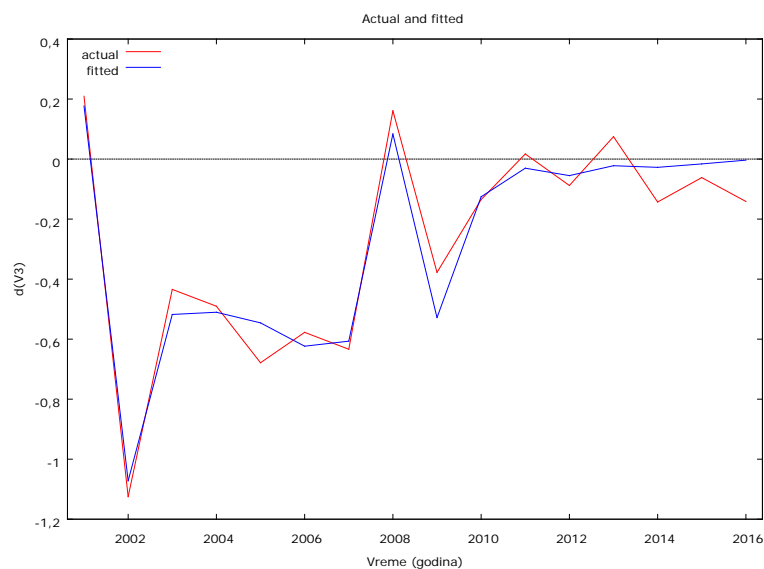
*Source:* Data processing done by author

Based on the values in Table 2 we see that the change of annual net income and unemployed residents have no statistically significant impact on the change in value of the velocity of money. Others have a statistically significant impact and influence on the change:

- if the level of savings change for one dinar, there will be a drop in velocity of money for  $5.91374e-06$
- if level of exchange rate change for one dinar, there will be an increase in the velocity of money  $0.0223214$
- if there is a change in the discount rate for 1%, then this will affect the increase in the velocity of money for  $0.0595685$
- if there is a change in the degree of monetization for 1 then velocity of money will increase for  $1.87647$

DW coefficient with a value of 2.02 tells us that the model does not suffer from problems of autocorrelation.

**Graph 2 - Actual and fitted data for velocity of money in Serbia**



*Source:* Done by author

To confirm that the model is correct it is necessary to do a specific series of tests to confirm this.

Ramsey RESET (REgression Specification Error Test) is a general test for the model specification error regarding omitted relevant variable, incorrect functional form and correlation between explanatory variable and error. In any of this cases misspecification causes biased and nonconsistent OLS estimates.

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**Table 3. Ramsey RESET test**

	coefficient	std.error	t-ratio	p-value
const	-1.71797	1.04866	-1.638	0.1454
d(Saving)	-8.23580e-06	5.59167e-06	-1.473	0.1843
Monetization	2.58027	1.68856	1.528	0.1703
d(Discountrate)	0.0887026	0.0803741	1.104	0.3062
d(Income)	1.03776e-05	1.89419e-05	0.5479	0.6008
d(Unemployed)	0.000673771	0.000785612	0.8576	0.4195
d(Exchagerate)	0.0305389	0.0193545	1.578	0.1586
yhat^2	1.26104	2.27403	0.5545	0.5965
yhat^3	0.856475	1.26442	0.6774	0.5199
Test statistic: F = 0.430556				
with p-value = P(F(2,7) > 0.430556) = 0.666				

*Source:* Done by author

Based on the p-value from table 3 that is greater than 0.05, we can confirm the null hypothesis and conclude that the model is not incorrectly specified. According to RESET test the model specification is a correct one.

The next test relates to an analysis heteroscedasticity model, this will be done with White's test. The following table provides the values of this test. White Heteroscedasticity test is employed under the null hypothesis that errors in regression model have constant variance regardless of the  $X_i$  value, i.e. stochastic errors are homoscedastic.

**Table 4. White's test**

	coefficient	Std.error	t-ratio	p-value
const	-0.333855	0.143194	-2.331	0.1020
d(Saving)	9.86183e-07	3.15888e-07	3.122	0.0524
Monetization	0.870264	0.358812	2.425	0.0937
d(Discountrate)	-0.00316187	0.00421845	-0.7495	0.5080
d(Income)	6.20957e-06	6.94172e-06	0.8945	0.4370
d(Unemployed)	0.000127312	5.87148e-05	2.168	0.1186
d(Exchagerate)	0.000232608	0.000692717	0.3358	0.7591
sq_d(Saving)	-3.66403e-012	1.39132e-012	-2.633	0.0781
sq_Monetization	-0.612086	0.250116	-2.447	0.0919
sq_d(Discountrate)	0.000566520	0.000378214	1.498	0.2311
sq_d(Income)	-2.56393e-09	1.58807e-09	-1.614	0.2048
sq_d(Unemployed)	6.49601e-06	2.95261e-06	2.200	0.1152
sq_d(Exchagerate)	-0.000158705	8.99120e-05	-1.765	0.1757
Unadjusted R-squared = 0.891522				
Test statistic: TR^2 = 14.264345				
with p-value = P(Chi-square(12) > 14.264345) = 0.284147				

*Source:* Done by author

Based on the obtained p-value from table 4, we see that is greater than 0.05, which means that it does not reject the null hypothesis that the model does not suffer from the problem of heteroscedasticity.

At the end collinearity test of observed variables is done. The table 5 shows the value of the VIF index. If the VIF index value exceeds 10.0 there is potential collinearity problem. Based on the obtained values of VIF coefficients can be concluded that the model has no multicollinearity problem.

**Table 5 - Collinearity test**

Variable	VIF
d(Saving)	2.236
Monetization	1.487
d(Discountrate)	2.390
d(Income)	1.166
d(Unemployed)	1.348
d(Exchagerate)	1.388

*Source:* Done by author

#### 4. Conclusion

The velocity of money attracts the attention of many researchers. They deal with the analysis of the dynamics of the velocity of money, factors that influence on velocity of money and creating a new statistical model to better define and measure the velocity of money. In this paper we analyzed the impact of a number of factors on the velocity of money in Serbia using multiple regression analysis. It was found that a statistically significant impact on change of velocity have changes in level of savings, level of monetization, changes in exchange rate and changes in the discount rate. Subsequent studies should extend the range of variables that will be taken in the analysis, such as inflation (both expected and achieved), and also to test some of the new models for measuring the velocity of money on empirical data related to Serbia.

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### **ANALIZA FAKTORA KOJI UTIČU NA BRZINU OPTICAJA NOVCA U SRBIJI**

*Apstrakt: Efekat koji novčana masa ima na privredu zavisi od količine novca u opticaju i brzine opticaaja novca. Brzina opticaaja novca nije konstantna vrednost kao što mnogi istraživači u svojim istraživanjima smatraju i brojni faktori utiču na kretanje vrednosti brzine opticaaja novca. U ovom radu analizirali smo neke od faktora koji utiču na promenu brzine opticaaja novca na primeru Srbije u periodu 2000. - 2016. godina pomoću višestruke regresione analize. Utvrđeno je da promene u deviznom kursu, štednji, eskontnoj stopi i stepen monetizacije imaju statistički značajan uticaj na promenu vrednosti brzine opticaaja novca.*

*Ključne reči: brzina opticaaja novca, regresiona analiza, Srbija.*