FACTA UNIVERSITATIS
Series: **Economics and Organization** Vol. 14, N° 1, 2017, pp. 31 - 41
DOI: 10.22190/FUEO1701031P

Original scientific paper

MONEY MULTIPLIER IMPACT ON INFLATION IN REPUBLIC OF SERBIA

UDC 336.748.12(497.11)

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Abstract. *The essential research intention in this paper is oriented toward considering the nature of money multipliers and their impact on inflation in Republic of Serbia. The analysis of research data includes data during period of 1997-2015 in order to achieve more effective results. Obtained results, after implementing adequate statistical procedures, emphasize the existence of negative and significant correlation between money multiplier m3 and inflation. Since M3 represents basis for forming m3 multiplier, this implicates that wider range of assets in monetary aggregate M3 have greater impact on inflation than other two monetary aggregates. Therefore, one of tasks for central banks should be higher control of M3 through m3 money multiplier analysis in order to prevent higher fluctuations in inflation rate.*

Key words: *Money multiplier, core inflation, m1, m2, m3, monetary base, central bank*

JEL Classification: E41, E51, E58

INTRODUCTION

Monetary stability represents one of crucial tasks for every central bank. Dynamic and uncontrolled increase in money supply can create troubles for home economy, where all economic calculations must be revised again and all effects of current economic policy will not bring expected results. In conditions of increased inflation, concern investors are starting to pull out their assets and to look for other places where they can invest them. Stable macroeconomic environment means a reasonably low inflation rate and small budget deficit that are conductive to sustained economic growth. On the other hand, high inflation reduces growth by reducing investment rate, but it also reduces productivity growth rate

Received October 08, 2016 / Revised November 11, 2016 / Accepted January 11, 2017
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(Fischer, 1993). Small economies have much bigger problem in dealing with inflation, since they do not possess adequate mechanisms that can effectively solve inflation problem. Also, these countries are very vulnerable to changes at international markets that can lead to huge turnover in future economy growth.

Narrow money (M1), broad money (M2) and broader money (M3) represent basic parts of every country money supply. The analysis of these monetary aggregates can help central banks understand changes in money supply and demand better, and take right measures in direction of preventing possible monetary crisis. In the past, many monetary crises had strong impact on national economies and in the end they resulted in increased unemployment rate, inflation and recession. By putting monetary aggregates in proportion with monetary base or reserve money (B), proper money multiplier is obtained. This ratio helps in analyzing changes in money supply and demand, but also in monetary habits of population of certain countries. For each monetary aggregate there is a money multiplier that provides more information about changes in money supply and thus we have *m1*, *m2* and *m3* money multipliers.

Periods of financial instability have radically changed overall monetary environment. In a situation when larger banks cannot meet their obligations it is the first signal that something is not right. They could face with huge withdrawal of deposits which could have terrible consequences for the banking market. This can be seen through money multiplier change whose role in monetary system stability is very important. With lower amount of broad money, central bank must react in order to avoid deeper monetary crisis. After the outbreak of crisis in 2007, USA, EU and Japan had dramatic decline in money multiplier. At the beginning this was the result of spontaneous financial disintermediation caused by the crisis, but in subsequent years this effect was magnified by prudential regulations (Dabrowski, 2016, p.16). All three major banks have reacted with increase in base money, but also with partial increase of M1 and M3 aggregates from time to time. Economic growth was still at very low level, but this helped countries escape from recession.

The *central research aim* of paper is to determine the connection between money multiplier and inflation in Serbia that was measured through core inflation since it includes many goods and products with non-regulated process. Consequently, additional research *objectives* are set:

- To identify the direction and strength of connection between money multipliers and core inflation in Republic of Serbia;
- To identify the relations between money multipliers for each monetary aggregate;

The research *methodology* involves the use of appropriate statistical procedures due to the characteristics of selected variables and number of observations in the sample. In this case linear regression, with the assistance of descriptive statistics, Pearson r coefficient and Beta (β) coefficient, the direction and strength of connection between the variables will be determined. Also, it will be discovered whether all variables have statistically significant impact on basic inflation.

Taking into consideration the research methodology and period of analysis which involves many events that have had impact on changes in money multiplier and basic inflation (such as beginning of transition process, a few political instabilities, global economics crisis, floods etc.) following hypotheses will be tested:

H1: There is a negative correlation between all money multipliers and core inflation.

H2: There is a negative and statistically significant relationship between m1 and core inflation.

H3: There is a negative and statistically significant relationship between m3 and core inflation.

The structure of the paper includes three more chapters besides introduction and conclusion. In the first chapter literature review will be presented where different authors discuss money multiplier and its impact on various indicators. The second chapter provides detailed analysis of money multiplier and basic inflation in Serbia with strong emphasis on events that led to changes in monetary multiplier and basic inflation and their later impact on domestic economy. In the third chapter, money multiplier impact on basic inflation in Serbia is analyzed with proper statistical procedures. That analysis will provide a few recommendations for better monetary stability in Serbia.

1. LITERATURE REVIEW

Modern economies are fully aware of the connection between monetary and real sector. The sensitivity of monetary sector lies in fact that when money supply is not controlled properly and when wrong decisions are taken, it can cause big problems for domestic economies. Sometimes low money supply can also be a problem because economies do not have adequate mechanisms to direct money supply to sectors where there exists real need for assets. Money multiplier is one of the best ways to follow changes in money supply and it is also a subject of interest for many researchers.

Hossain (1993) developed a money multiplier model of the money supply for Bangladesh using quarterly data from 1972-1993. Using a component approach of the money multiplier, the author finds that only deposit-currency ratio equation is stable, but the narrow and broad money multiplier equations are found to be unstable. The author argues that the instability in the components of money multiplier makes it difficult for the monetary authority in Bangladesh to effectively conduct monetary policy through monetary targeting. He suggested that the central bank should make an effort to stabilize the value of the money multiplier for effective monetary conduct.

The connection between money multiplier and inflation rate in Japan during 1985-2004 period was analyzed by *Ilda* (2005). Research showed that from 1991 to 2004 money multiplier constantly declined because of strong deflation expectations. On the other hand, low money multiplier also resulted in a cash ratio raise of the non-financial sector and the excess reserve possession of banks. In the years after 2000 money multiplier accelerated on a short term due to low deflation expectations. Author also found that the validity of "the bad loan hypothesis" is very low as an explanation for the sharp fall of the money multiplier and that monetary policy was too tightening for implementing proper measures.

In their research, *Polster* and *Gottschling* (1999) investigated the stability of the German money supply during 1991-1998 through money multiplier. Study showed that m3 and Bundesbank main operating instrument – the overnight rate - have significant long-term relationship which indicates that changes in overnight rate can have strong impact on m3. However, the increasing money multiplier reflects the rising importance of influences on the German money supply which are not fully controllable by the Bundesbank. Controlling the money supply became very difficult during the 90s, but still some financial innovations that appeared after German unification were in position to guarantee price stability.

Hon Chu (2006) examined the Canadian experience with money multiplier during 1970-2004, where a zero reserve requirement regime has become fully effective since 1994. The findings showed that all money multipliers, except m1, under new regime have

become less volatile than before. Furthermore, short and long-term *ex ante* forecasts based on the Holt-Winters exponential smoothing model indicate that the money multipliers have apparently not become more unpredictable. Overall, the findings do not lend strong support to the monetary control argument for reserve requirements.

The long-term stability of money multiplier in India during 1978-1996 was tested by *Darbha* (2002). Most empirical studies have examined long-term stable relation between monetary aggregates and reserve money within the framework of cointegration and have interpreted their inability to reject the hypothesis of no cointegration as an indication of instability in money multiplier. Contrary to all previous studies, author proved the existence of a stable, but time-varying long-term relationship between monetary aggregates (M1 and M3) and adjusted reserve money. The results also indicate that observed variation in parameters could be characterized by a discrete shift around 1989, generated possibly by discrete changes in the conduct monetary policy such as the removal of controls on interest rates in the inter-bank call money ceiling rates in inter-bank money markets or deregulation of deposit rates.

Money multiplier model for Pakistan, using monthly data covering the period from 1972 to 2009, was tested by *Khan* (2009). The results showed that money multiplier was non-stationary for entire period. Cointegration between money supply and monetary base was also tested. The coefficients restrictions $\beta_0=0$ and $\beta_1=1$ are satisfied only in post-liberalization period (1992-2009). This implies that the monetary authorities may control money supply by controlling the reserve monetary to achieve the price stability. The monetary authority used many mechanisms to control money supply growth by controlling the growth of base money to achieve the objective of price stability in short-term. The author recommended consideration of relationship between money supply and reserve money as a policy guide rather than the constancy of the money multiplier for the conduct of the monetary policy in short-term.

Downes et al (2006) examined the stability of money multiplier for six African countries using non stationary tests without and with structural breaks. They find that, when structural breaks are ignored, the null of unit root hypothesis is accepted while it is rejected when structural breaks are taken into consideration.

In their study, *Adam* and *Kessy* (2010) discussed the stability and predictability of m2 multiplier in the context of a reserve money anchor for inflation in Tanzania. Analysis showed that m2 multiplier is stable over the long run so average broad money has grown one-for-one with reserve money. However, in a short run multiplier is not so constant. Negative correlation between base money and the multiplier attenuates the impact of changes in base money on broad money so full pass-through should be taken around 24 months. The components of M2 multiplier are strongly seasonal, so monetary authorities must react on time to avoid huge variations in multiplier that can cause serious inflation growth.

The stability of money multipliers in Turkey for the period of 1990-2004 was investigated by *Saatcioglu* (2006). The results showed that the processes that extend the basic money supply to the final monetary aggregates are unstable, decreasing the effectiveness of monetary policies implemented by the Turkish central bank. In addition, the co-integration analyses showed that there are no long run relationships between the sub-components of money multipliers and money supply measures, indicating that traditional monetary theory prescriptions cannot be used to implement monetary policy in Turkey.

Zhang and *Ruan* (2013) have gone a step forward and analyzed the influence of electronic currency on money multiplier in China from 1993 to 2004. Narrow money multiplier (m1) has negative correlation with cash deposit ratio (r_c) which demonstrates the rapid development

and extensive use of e-money decreasing the cash deposit ratio and then enlarging money multiplier. The narrow money multiplier has positive correlation with e-money utilization ratio, which demonstrates the higher e-money utilization ratio causing the greater money multiplier. Consequently, the rapid development and extensive use of electronic currency, to some extent, does have an impact on money multiplier.

2.MONEY MULTIPLIER BACKGROUND IN SERBIA

The complexity of money multiplier lies in the fact that it is partially controlled by central banks. Bearing in mind that central bank has high degree of control over reserve money, this practically means that money multiplier is stable and money stock can be precisely controlled (Đurović – Todorović & Đorđević, 2010, p.137). Otherwise, money multiplier can be unstable and unpredictable, which creates a hard task for central bank in order to control money supply. Money multiplier can be presented through following formula:

$$m = \frac{M}{B}$$

In presented formula m is money multiplier, M money stock or overall sum of monetary aggregates and B reserve money or monetary base. In normal conditions, money multiplier has a positive sign and value above one, but it is more often positive and just above zero. Fewer variations between variables will make money multiplier more stable. Another important element in the money multiplier model which has been analyzed by a number of researches is the direction of causality between M and B in implementing a reserve money program, to ensure that the growth rate of B is not an endogenous variable in such a way that causality runs from money supply to monetary base. This is the case, for example, when the monetary base is essentially influenced by currency to deposit ratio and the private sector portfolio decisions.

Money multiplier analysis must include determinants that cause certain behavior of banking and non-banking subjects, since they can provide better view into money supply structure (Kožetinac, 2009., p.573). Factors that determine money multiplier are (Mishkin, 2004, p.378):

1. Currency ratio (*c*),
2. Excess reserve ratio (*e*),
3. Required reserve ratio (*r*).

An increase in *c* ratio means that depositors are converting some of their deposits into currency. Checkable deposits undergo multiple expansion while currency does not. When checkable deposits are being converted into currency, there exists a switch where one of money supply components undergoes multiple expansion to one that does not. Overall level of multiple expansion declines and so does its money multiplier. This way money multiplier is negatively related to *c* ratio. Same as *c* ratio, *e* ratio also has negative correlation with money multiplier. When *e* ratio increases, this means that banking system has fewer reserves to support checkable deposits. In these conditions, banks will contract their loans which will cause a small decline in level of checkable deposits, but it will also cause a decline in money supply and money multiplier. If *c* ratio increases, the same level of reserves cannot support a large amount of checkable deposits because

deposits will always be on higher level when required reserves start to grow. Due to these circumstances banks will be pushed to contract their loans which will cause a decline in deposits and hence in the money supply. At the end, with less multiple deposit expansion, money multiplier will fall and so we have negative correlation between money multiplier and *r* ratio. For the theory to hold, the amount of reserves must be a binding constraint on lending and the central bank must directly determine the amount of the reserves (Mcleay et al., 2014, p.15). This way banking reserves will have impact on money multiplier.

This description of the relationship between monetary policy and money can be found in many introductory textbooks, where central banks determine the quantity of broad money via a "money multiplier" by actively varying the quantity of reserves (Benes & Kumhof, 2012). In that view central banks choose the quantity of reserves which are then "multiplied up" to a much greater change in bank deposits as banks increase lending and deposits.

Table 1 Money multiplier values in Serbia for 1997-2015 period

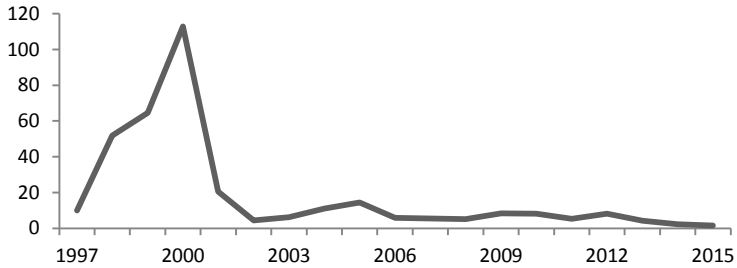
	m1	*m2*	*m3*
1997	1,01	1,35	1,74
1998	0,76	1,05	1,51
1999	0,90	1,13	1,51
2000	0,46	0,56	1,12
2001	0,70	0,82	1,51
2002	0,92	1,09	1,89
2003	0,86	1,08	2,12
2004	0,75	0,99	2,18
2005	0,58	0,77	1,85
2006	0,50	0,70	1,60
2007	0,57	0,89	2,06
2008	0,47	0,77	1,93
2009	0,48	0,82	2,26
2010	0,47	0,76	2,53
2011	0,48	0,80	2,48
2012	0,49	0,77	2,62
2013	0,60	0,85	2,67
2014	0,71	1,01	3,06
2015	0,77	1,08	3,07

Source: Calculation made by authors

Money multiplier values in Serbia showed same direction of changes, with the exemption of m3 for some years. For most of analyzed period m1 and m2 multiplier values were under 1, which tells that monetary expansion was not so dynamic in a way of securing more funds that could at the end lead to higher money multiplier value. Contrary to m1 and m3 multiplier in table 1 it can be seen that m3 multiplier volatility is far more stable than other two multipliers (although it includes more monetary variables). Values for m3 multiplier are above 1 and in last two analyzed years are even above 3, which is a good result.

For better understanding of money multiplier volatility, some facts must be added. Cash versus deposit proportion is very useful in examining multiplier, where higher proportion of deposits can raise multiplier value. It is assumed that final proportion should be 70:30 or higher in favor of deposits, but this was not a case in Serbia for a long time.

During the 1990s wars, hyperinflation, banking frauds and low economic activity spread the use of cash money leaving very little space for deposits. By the beginning of 2000s, things went better and with revitalized banking system, share of deposits started to grow. The outbreak of global crisis also was felt in Serbia with low GDP growth and increased unemployment. Central bank was forced to increase reserve requirements several times in order to prevent problems in banking system and this decision caused money multiplier fall. From 2012 money multipliers are on constant rise, but huge presence of gray economy blocks further increase of money multiplier, so this problem has to be solved. Only in that way monetary expansion will speed up and banks can provide more assets for big investments. In the end, money multiplier will continue to grow and it will be at more stable level.



Graph 1 Core inflation during 1997-2015 period

For a better look at money multiplier determinants, core inflation is included in whole story. National Bank of Serbia (NBS) uses exclusion method for core inflation calculation. In this process from calculation are excluded all agriculture products, electricity, coal and natural gas, cigarettes, milk, medicines, postal services and all other products and services whose prices are under some kind of state regulation (Maravić et al, 2009, p. 99). Graph 1 shows that core inflation was very high during the first three years of analyzed period, but then inflation rate was reduced to more reasonable level with several fluctuations during the remaining period. Comparing to money multiplier values, core inflation rate raised when money multiplier value declined.Reversely, rate reduced when multiplier increased. Linking core inflation with money multiplier, it should be mentioned that a large increase in the quantity of required reserves in the banking system should not be inflationary, since the central bank can adjust short-term interest rates independently of the level of reserves (Keister & McAndrews, 2009). In developing countries, central banks need a lot of time to adjust their mechanisms in order to calculate the exact level of reserves that will not create higher inflation rate, so this work can request some detailed analysis.

3. METHODOLOGY AND RESULTS

The research presented in this paper includes data about money multiplier and core inflation from 1997 to 2015. For the purpose of research, data were used from NBS publication Statistical Bulletin that is published on a monthly base. Values for each money multiplier are calculated on the basis of each monetary aggregate and reserve money for every year. The methods that are used in order to conduct analysis are: descriptive statistics, correlation analysis and linear regression.

Table 2 Descriptive statistics

	N Statistic	Min Statistic	Max Statistic	Mean Statistic	Std. Dev Statistic
m1	19	0,46	1,01	0,6568	0,17817
m2	19	0,56	1,35	0,9100	0,18980
m3	19	1,12	3,07	2,0908	0,54452
Core inflation	19	1,60	112,12	18,4368	28,28367
Valid N (listwise)	19				

Source: Calculation made by authors

Since variables include period of 19 years, values for all variables in that period were analyzed. As for variables values, their ranges can be seen in table one and so we have range 0,46-1,01 for m1, 0,56-1,35 for m2 and 1,12-3,07 for m3. Due to bigger content of variables, m3 multiplier has higher values than other two variables. Core inflation has values in range from 1,60 to 112,12. Among the variables, m3 and core inflation have the highest mean and standard deviation value.

Table 3 Results of ANOVA analysis

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	6656,517	3	2218,839	4,298	0,022
Residual	7742,868	15	516,191		
Total	14399,384	18			

Source: Calculation made by authors

Based on table 3 and the coefficient value p<,05 existence of statistically significance for this model and its variables is confirmed. This means that proper linear regression and correlation coefficient analysis can be implemented with different results for each variable. In this model core inflation is selected for dependable variable, while m1, m2 and m3 are undependable variables.

Table 4 Correlation analysis

		m1	m2	m3	Core inflation
m1	Pearson correlation	1			
	Sig. (2-tailed)				
	N	19			
m2	Pearson correlation	0,927**	1		
	Sig. (2-tailed)	0,000			
	N	19	19		
m3	Pearson correlation	-0,120	0,105	1	
	Sig. (2-tailed)	0,625	0,659		
	N	19	19	19	
Core inflation	Pearson correlation	-0,022	-0,210	-0,656**	1
	Sig. (2-tailed)	0,927	0,387	0,002	
	N	19	19	19	19

**. Correlation is significant at the level 0.01 (2-tailed)

Source: Calculation made by authors

Results illustrated in table 4 show that core inflation has negative correlation with all money multipliers. With this view the hypothesis H1 is confirmed, there is a negative correlation between all money multipliers and core inflation. Here must be taken a note that although the negative correlation exists, only m3 has statistically significant relation with core inflation (0,002) and that relation is the strongest among variables (-0,656). This way the hypothesis H3 is confirmed also, because negative and statistically significant relation between m3 and core inflation really exists. On the other hand, H2 can be rejected, because although there is negative relation between m1 and core inflation, there is no statistical significance. It is also interesting that only m1 and m3 have strong and statistically significant relation (0,927) between themselves and not with m3 or core inflation. Multipliers m1 and m2 have just a little difference between themselves, since M2 aggregate, in addition to M1 includes other dinar deposits, both short- and long-term. On the other hand, M3 aggregate includes short- and long-term foreign currency deposits beside M2, which makes a difference to other aggregates. This is why m1 and m2 multipliers are so close in their relations than m3 multiplier.

Table 5 Coefficients table

Model	Unstand. coefficients		Stand. coefficients	Sig.	95% Confidence Interval for B		Collinearity statistics	
	B	Std. error	Beta		Lower bound	Upper bound	Tolerance	VIF
(Constant)	107,656	31,766		0,004	39.949	175,383		
m1	56,844	98,090	0,358	0,576	-152,229	265,917	0,094	10,651
m2	-72,024	91,927	-0,483	0,446	-267,961	123,914	0,094	10,651
m3	-29,194	12,136	-0,562	0,029	-55,061	-3,327	0,656	1,523

Source: Calculations made by authors

To discover the true impact of money multipliers on core inflation, linear regression was used. With core inflation as dependable and money multipliers as independent variables, based on table 5 only m3 multiplier has statistically significant impact on core inflation. Also, m3 multiplier is the only one that does not show multicollinearity. Single increase in m3 multiplier by 1% will decrease core inflation for 0,562. This can be explained in a way that when multiplier starts to grow overall deposits start to grow, too. Increased deposits do not have impact on core inflation on a short-term, but in future they will be activated for different kind of ventures so the final result will be increased core inflation rate.

CONCLUSION AND RECOMMENDATIONS

Money multiplier is a very important tool in monetary policy. With setting up the level of reserve requirements central banks want to send an effective message to market participants that they carry about domestic monetary stability. Central bank role must be very strict, because modern way of business requests from banks to decide first what profitable opportunities for them are and then how to attract more deposits in order to lend money for clients. Uncontrolled creation of money can cause big inflation problem, so central bank sometimes must use all available mechanisms to prevent money supply from becoming “overheat problem”. When central banks follow changes in money multiplier, it will be easier for them to react right on time and to slow down potential inflation increase.

Serbia was struggling with inflation for a very long time due to many circumstances. Lack of banking deposits created problem for NBS, because in one moment it could not control overall money supply and demand, because people relied on using cash for their payments. Things have changed through time and money multiplier became stable, which is a sign of monetary recovery. Also, inflation rate has been low for several years and these changes have created good basis for future progress of domestic economy. Next big task for central bank will be to create efficient mechanisms that will prevent huge amount of "hot money" from increasing inflation and to set up money multipliers on a level that cannot harm monetary stability of the country.

In this study following research results were achieved:

- By correlation analysis, hypothesis H1 was confirmed, which means that all money multipliers have negative correlation with core inflation with m3 multiplier as the only one that has statistically significant relation with core inflation.
- Analysis also showed that m1 multiplier has negative relation with core inflation, but since it is statistically significant, hypothesis H2 should be rejected.
- Correlation analysis and linear regression showed that m3 multiplier has negative and statistically significant relation with core inflation so hypothesis H3 is accepted.

Also, results of research are providing answers to all the objectives set in the introduction:

- All money multipliers have negative correlation with core inflation.
- Among money multipliers m3 has the strongest (-0,656) and the only statistically significant one (0,002).
- Between m1 and m2 multiplier there exists very strong (0,927) and significant relation, which is not the case for the rest of relations with money multipliers.

This study recommended that:

1. Central bank should continue with tightening up the reserve requirements during period of crisis, but this should be also done in a period of dynamic growth so trap with "hot money" couldbe skipped.
2. Government and authorities must work on reducing gray economy, since it can stir up more cash use, whichcan create inflation in the future.
3. Interest rate must be regulated in such a way that it is neither too low nor too high in order to avoid inflation rate raise, but also to motivate market participants to be more active on the market.
4. Currency swaps and exchange must be regulated in such a way that sudden changes in exchange rate do not harm total amount of money in a very serious way.
5. Banking system must be more rational in a way that planning assets must come first and then directions for profitable projects. With additional regulation, banks will be stopped from investing funds into some dangerous projects that will lead them to bankruptcy and create bigger money supply that will become a problem for central bank to control.

Since m3 multiplier has the strongest impact on core inflation, in further research structure of m3 multiplier should be analyzed with more detail in order to see which component of single M3 aggregate has strong impact on core inflation. Further research should also analyze money creation in Serbia in context of attracting potential foreign investments and their possible impact on Serbian monetary system.

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UTICAJ MONETARNOG MULTIPLIKATORA NA INFLACIJU U REPUBLICI SRBIJI

Osnovna istraživačka namera ovog rada usmerena je na analizu prirode monetarnog multiplikatora i njegov uticaj na inflaciju u Republici Srbiji. Kako bi se postigli efektivniji rezultati u analizu su uključeni podaci za period 1997-2015. Rezultati istraživanja do kojih se došlo primenom odgovarajućih statističkih postupaka naglašavaju postojanje negativne i statistički značajne korelacije između m3 monetarnog multiplikatora i inflacije. Kako monetarni agregat M3 predstavlja osnovu za izračunavanje m3 monetarnog multiplikatora, ovo ukazuje na to da veći broj elemenata unutar M3 monetarnog agregata imaju daleko veći uticaj na inflaciju u odnosu na druga dva monetarna agregata. Zato je neophodno da centralna banka posveti veću pažnju kontroli M3 monetarnog agregata i da prati promene unutar m3 monetarnog multiplikatora kako bi se sprečile veće fluktuacije u stopi inflacije.

Ključne reči: *monetarni multiplikator, bazična inflacija, m1, m2, m3, monetarna baza, centralna banka.*