THE IMPACT OF FISCAL AND MONETARY POLICY ON INFLATION: AN EMPIRICAL STUDY RELATED TO ROMANIA

Ramona-Mihaela BÂZGAN
The Bucharest University of Economic Studies
6 Piata Romana, 1st district, Bucharest, Romania
bazgan.ramona.mihaela@gmail.com

Abstract. *The study would develop an econometric Vector Error Correction Model (VECM model) that would determine the impact of fiscal policy and monetary policy on the evolution of inflation rate. There were used quarterly time series data over the period of 2007 (1st quarter) – 2017 (4th quarter) on the case of Romania. In order to explain the impact of fiscal policy and monetary policy on the evolution of inflation rate, the econometric model involved endogenous variables such as the growth rate of the money supply, the rate of change in the inflation rate and the rate of change in the public budgetary balance. Furthermore, the analyzed econometric model was used to forecast over a period of t+4 (4 quarters) the evolution of the variable budgetary balance along with the evolution of money supply using as an exogenous variable the annual target value computed by the central bank for the inflation rate. Thus a positive impulse or a negative impulse in the value of the rate of inflation could explain any influence on the value of money supply or the value of budgetary balance. The Granger causality test applied to the VECM model revealed a unidirectional causality form between the variable budgetary balance to the variable rate of inflation and from the variable inflation to the endogenous variable represented by the value of money supply. This revealed that an increase in the level of budgetary balance would be computed in an increase in the level of the inflation rate. Moreover, an increase in the rate of inflation would lead to an increase in the value of money supply according to the results generated on time series data taken into consideration over the analyzed period. The VECM model revealed under the variance decomposition that the fiscal policy such as the evolution of public revenues and of public spending would have a significant impact on inflation. On the other hand, monetary policy tended not to have a significant impact on the evolution of inflation over the analyzed period of time.*

Keywords: *fiscal policy; monetary policy; inflation; money supply; Vector Error Correction Model; forecast; Granger causality test.*

Introduction

Fiscal and monetary policies would generate an impact on the evolution of macroeconomic indicators. Fiscal policy could influence macroeconomic variables through each type of tax implemented by the state in order to generate higher public revenues or by implementing different values in the distribution of public revenues to public spending. Monetary policies could generate higher or lower money supply in the entire economy of a state that would further influence the level of interest rates and the level of inflation rate along with the market price levels which could further impact other macroeconomic indicators such as consumption, investment level, unemployment rate. Types of fiscal and monetary policies applied by the state in terms of inflation rate fluctuations have a significant impact on the entire development of the economy.

The first part of the article presents the recent specialty literature which involves econometric models that revealed the relationship between fiscal and monetary policy and their implications on inflation. The second part involves the methodology, namely the estimation of the econometric Vector Error Correction Model (VECM) with the chosen endogenous variables such as the variation of the inflation rate, the variance on the budgetary balance, the rate of change in the money supply. Fiscal policies would be generated in this study by analyzing trends in public spending and public revenues and their substraction under the value of budgetary balance. Monetary policy would be reflected by analyzing the evolution of money supply generated in the market. The level of prices on the market will be reflected in this study by analyzing the evolution of the inflation rate.

The last part involves the conclusion consisting in forecasting the values of the endogenous variables chosen in the econometric model using as exogenous variable the annual target rate for inflation revealed on the statistical data published by the central bank.

Literature review

The impact of fiscal and monetary policy on inflation has been analyzed on several recent econometric studies. Boiciuc (2015) analyzed a Vector Autoregressive Model in order to explain the impact of fiscal policy on the main macroeconomic variables such as gross domestic product, inflation, interest rate, employment. The impact of fiscal shocks on macroeconomic variables related to Romania over the period of 2000:1 – 2012:4 was revealed not to be so significant. The variables used in order to compute the Vector Autoregressive Model were real output, inflation, interest rate, government expenditure, tax revenues.

Agbonlahor (2014) analyzed a Vector Error Correction Model on time series related to United Kingdom over the period of 1940-2012. The econometrical model revealed the impact of monetary policy on economic growth. The study revealed a long-term relationship between these variables. Inflation rate and money supply seemed to be significant to the evolution of economic growth.

Georgantopoulos and Tsamis (2011) analyzed a Variance Correction Model in order to develop the causality between budget deficit, consumer price index, gross domestic product and nominal effective exchange rate related to Greece over the period of 1980-2009. Empirical evidence revealed a cointegration between the chosen variables among with one-way causalities from effective exchange rate to budget deficit and from budget deficit to gross domestic product. It was also revealed a bidirectional causality link between effective exchange rate and consumer price index. The study disclosed no significance link between budget deficit and inflation in case of Greece.

Giordano, Momigliano, Neri and Perotti (2007) analyzed a Vector Autoregressive Model in order to study the effects of fiscal policy on private gross domestic product, on inflation and on the long interest rates using time series data related to Italy over the period of 1982:1 to 2004:4. Regarding the inflation, it was revealed that the response of inflation to fiscal policy has a small and short-term impact.

Cheung, K.I. and Cheung, L. (1993) applied the J-test to a IS-LM model consisting using as variables the rate of change in inflation rate, the rate of change in government tax revenue, the rate of change in government spending, the rate of change in money supply for Australia over the period of 1961-1990. Empirical findings revealed no significant impact of money supply on inflation. Fiscal policy revealed to be significant in explaining the level of inflation and unemployment.

Methodology

The econometric model chosen for this study would explain the impact of fiscal and monetary policy on the inflation rate. The study used quarterly statistical time series related to Romania for the period from 2007 (1st quarter) to 2017 (4th quarter). Time series were generated by using the Eurostat database and the data provided by the National Bank of Romania reports.

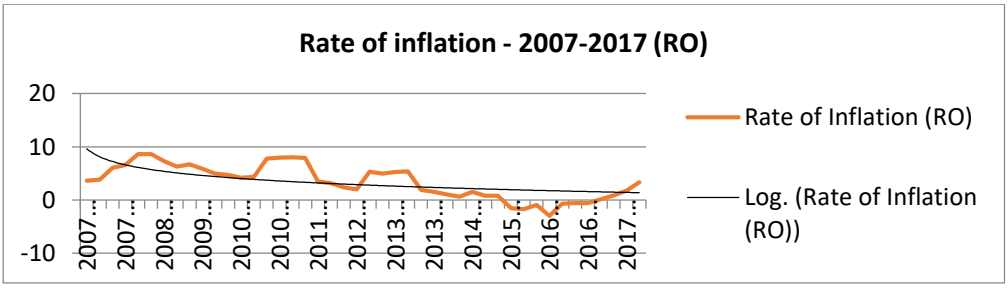

Figure 1. Evolution of the rate of inflation – Romania on the period of 2007-2017

As it can be displayed on Figure 1, the inflation rate recorded a downward slope from 2008 to 2016 – 2nd quarter, when it was registered a deflation rate of 2.63 percent. Before the year 2016, the value of inflation rate began to increase, the slope started to register an ascending trend and is maintaining this trend up to 2018.

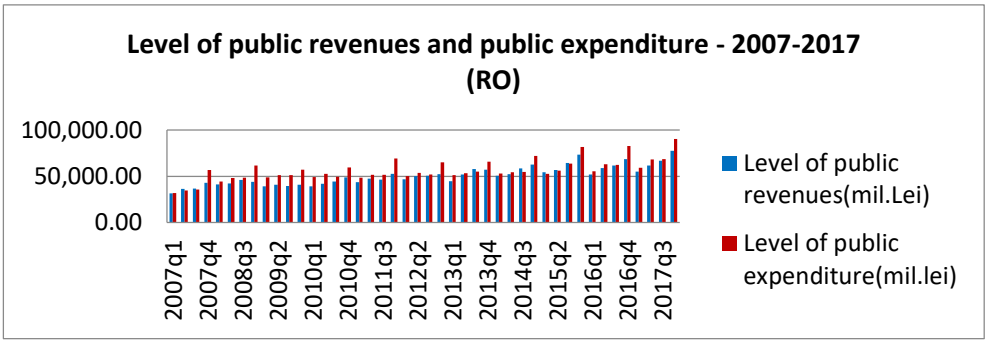

Figure 2. Evolution in the level of public revenues and public expenditure – Romania - 2007-2017

There is an upward slope in terms of public revenue and government spending. According to Figure 2, the tendency is that public expenditure overcomes the level of public revenue over the analyzed period, registering in this way a deficit in the value of budgetary balance.

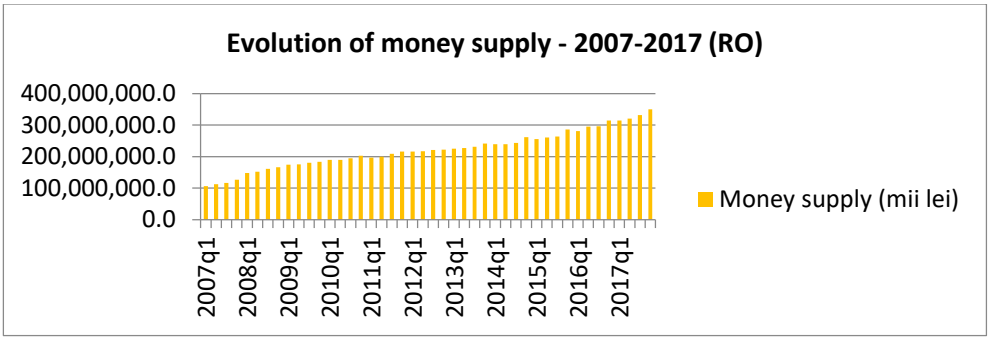

Figure 3. Evolution in the level of money supply – Romania – 2007-2017

The chosen econometric model comprises as endogenous variables the rate of change in inflation, the rate of change in the budget deficit, the rate of increase in the money supply on the Romanian market. The econometric model was developed using 44 observations with quarterly frequency, respectively 2007(1st quarter) - 2017(4th quarter). The econometric model was implemented using Eviews software.

Table 1. Notations of the endogenous variables used in the VECM model (Source: author's own research)

The name of the variable	Notations
Rate of change in inflation (%)	inflation
Rate of variance in budgetary balance(%)	budgetary balance
Rate of growth in money supply (%)	money supply

In order to reveal the influence of fiscal policy and monetary policy on inflation rate, the chosen econometric model chosen would be represented by the following equation:

$$inflation_{1t} = \alpha + \beta_1 inflation_{t-1} + \beta_2 inflation_{t-2} + .. + \beta_z inflation_{t-z} + \Upsilon_1 budgetary\_balance_{t-1} + \Upsilon_2 budgetary\_balance_{t-2} + .. + \Upsilon_z budgetary\_balance_{t-z} + \delta_1 money\_supply_{t-1} + \delta_2 money\_supply_{t-2} .. + \delta_z money\_supply_{t-z} + \varepsilon_t \quad (1)$$

Where:

- β, Υ, δ represents the coefficients that could significantly have an impact on the inflation rate;
- budgetary balance, inflation and money supply represent the endogenous variables used for the Vector Error Correction model;
- ε_t represents the error term;
- z represents a notation that refers to the fact that time series start from z and end up to a p number of lags.

Regarding the stationarity of the time series values, as shown in the values displayed on *Table 2*, inflation and budgetary_balance would be stationary at level, respectively integrated at grade I(0). In terms of time series generated for money_supply variable, t-static at first difference is -9.89 while p-value is 0.00 and the critical value is equal to -4.20. Because the probability is less than 5%, we will consider money_supply variable integrated of order one I(1). The step of evaluating the stationarity for the chosen variables was implemented in order to deseasonalized and remove any trend or shock

in the evolution of the time series which would further be necesarrely in the prediction of the future values of the chosen time series.

Table 2. Augmented Dickey-Fuller test
(Source: author's own research using Eviews software)

Unit root test at level		Intercept			Trend with intercept		
		P-value	T-static	Critical value	P-value	T-static	Critical value
Variable	inflation	0.0000	-6.97	-3.59*	0.0000	-6.95	-4.19*
	budgetary_ balance	0.0000	-6.37	-3.59*	0.0000	-6.70	-3.59*
	money supply	0.9773	0.3346	-3.60*	0.9906	-0.20	-4.20*

Asterisk * denotes statistically significant values at 1% level.

Table 3. Lag Length Selection Criteria
(Source: author's own research using Eviews software)

Lag	LogL	Sequential modified LR test statistic	Final prediction Error	Akaike Information Criterion (AIC)	Schwarz Information Criterion (SC)	Hannan-Quinn information Criterion (HQ)
0	-97.54071	na	0.039876	5.291616	5.420899	5.337614
1	-80.82670	29.90928	0.026631	4.885616	5.402748	5.069608
2	-68.21455	20.57773	0.022251	4.695502	5.600484	5.017488
3	-52.38657	23.32544	0.015932	4.336135	5.628966	4.796115
4	-31.21341	27.85942*	0.008809*	3.695442*	5.376123*	4.293416*
5	-26.26172	5.733528	0.011824	3.908512	5.977042	4.644479
6	-14.12528	12.13644	0.011398	3.743436	6.199815	4.617397

As shown in *Table 3*, p number of lags that would be included in the prediction and in the deduction of the causality between the chosen endogenous variables would consist in a number of 4 lags. As seen in Table 3, the lag length criteria would consist in chosing the minimal values computed for Akaike Information Criterion and Schwarz Information Criterion.

Table 4. Cointegration Rank Test
(Source: author's own research using Eviews software)

Number of cointegrating vectors	Eigenvalue	Trace Statistic	0.05 Critical value	Probability
None*	0.474453	40.51658	24.27596	0.0002
<=1*	0.235145	13.49731	12.32090	0.0316
<=2	0.051901	2.238438	4.129906	0.1588

As displayed in *Table 4*, the Cointegration Rank Test indicated 2 cointegrating number of vectors at the 0.05 level due to the p-value which is higher than 5%. The evidence of existing of vectors at the 0.05 level shows a long-run relationship between the chosen endogenous variables. Thus, a Vector Error Correction model would be implemented using as endogenous variables such as inflation, money supply and budgetary balance.

Table 5. The results of the VECM Model
(Source: author's own research using Eviews software)

Variable	Coefficient	Standard Error	t-Statistic	Probability
CointEq1	-0.118712	0.33826	2.80684	
D(budgetary_balance(-1))	-0.120158	0.02114	-5.68485	0.1231
D(budgetary_balance(-2))	-0.032917	0.02313	-1.42331	0.8758
D(budgetary_balance(-3))	0.004894	0.04365	0.11212	0.5228
D(budgetary_balance(-4))	-0.028214	0.03162	-0.89235	0.5487
D(inflation(-1))	0.246130	0.246130	1.16245	0.5023
D(inflation(-2))	0.424070	0.15574	2.72287	0.0282
D(inflation(-3))	-0.22736	0.31091	-0.73129	0.5780
D(inflation(-4))	-0.48646	0.20788	-2.34008	0.9166
D(money_supply(-1))	3.904774	3.49622	1.11686	0.3807
D(money_supply(-2))	4.946580	3.39689	1.45621	0.7028
D(money_supply(-3))	-4.253700	6.99637	-0.60799	0.3894
D(money_sypply(-4))	-4.357590	6.40185	-0.68068	0.4717
c	0.60898	0.13028	0.46742	0.0276
R-squared	0.821108			
Adjusted R-squared	0.728084			
F-statistic	8.826862			

By implementing the VECM Model, the results showed that 82.11% in the evolution of inflation would be explain by the evolution of money supply and of the budgetary balance.

Table 6. Serial LM Test
(Source: author's own research using Eviews software)

Lags	LM-Stat	Probability
1	19.0	0.0247
2	14.1	0.1164
3	5.57	0.7812
4	9.14	0.4236

According to *Table 6*, by implementing Serial LM Test and Heteroskedasticity Test, the validity of VECM model was approved due to the probability which registered a level higher than 5%.

Results displayed on *Table 7* indicate a unidirectional causality from budgetary balance to inflation variable and from budgetary balance to money supply due to the value of probability less than 5%. This indicates that any increase in the level of budgetary balance would consist in an increase in the level of inflation rate and money supply. Furthermore, due to the p-value generated of less than 5%, an increase in the rate of inflation would lead in an increase in money supply according to the results generated on time series used on Romania. As a consequence, it was generated that any change in budgetary balance could have a further impact on the forecast of the values of money supply and of the inflation. Due to the fact that no bidirectional causality was released, the contrary could not be explained on the case of Romania.

Table 7. Granger Causality Tes t
(Source: author's own research using Eviews software)

Null Hypothesis	Obs	F-Statistic	Probability
Inflation does not Granger Cause budgetary_balance Budgetary_balance does not G ranger Cause Inflation	40	2.86068 5.92965	0.0398 0.0012
Money_supply does not Granger Cause Budgetary_balance Budgetary_balance does not Granger Cause Money_supply	40	1.88229 6.27470	0.1385 0.0008
Money_supply does not Granger Cause Inflation Inflation does not Granger Cause Money_supply	40	4.03130 1.21858	0.0096 0.3230

Source: author's own research using Eviews software.

According to data displayed in *Table 8,* the variance of inflation is explained at about 38.1% by the evolution of budgetary balance while money supply seemed to have an insignificant influence of only 3.84% at period 10 when explaining the variance of inflation.

Table 8. Variance decomposition
(Source: author's own research using Eviews software)

Variance Period	S.E.	Money supply	Budgetary balance	Inflation
1	0.774973	0.237526	10.86440	88.89807
2	0.778206	0.236928	11.20895	88.55412
3	1.007510	0.836379	35.93789	63.22573
4	1.074887	3.393001	32.52943	64.07756
5	1.078873	3.439681	32.37753	64.18279
6	1.119804	3.243895	30.41560	66.33990
7	1.165756	3.972310	28.40518	67.62251
8	1.319639	3.458759	37.18038	59.36086
9	1.338833	3.846348	37.43903	58.71463
10	1.348905	3.846561	38.10182	58.05162

After the development of the causality forms generated between the variables, a forecast of the values of budgetary balance and money supply was implemented over a period of t+4 (4 quarters). The inflation was used as exogenous variable as it was generated in the reports retrieved from the National Bank of Romania reports. Due to the fact that on the first quarter of 2018 the inflation rate in Romania was approximately 0.5% higher than it was on the 4th quarter of 2017, on the first scenario of forecast (Baseline) we assume that the inflation rate on the first quarter of 2018 was higher with 0.5% than the previous quarter and furthermore in order to reach the annual target value computed for inflation rate by the central bank, we assumed that the inflation rate would decrease each quarter with 0.5% than the previous quarter until the 4th quarter of 2018.

Table 9. Generating scenarios in order to predict the evolution of variables (Source: author's own research using Eviews software)

Forecasted periods	Baseline - scenario		
t = 2017(q4)	Budgetary_ balance	Inflation (%variation)	Money_ supply
t+1 (q1)	13.14424	+0.5	0.11
t+2 (q2)	4.401088	-0.5	0.11
t+3 (q3)	5.239381	-0.5	0.06
t+4 (q4)	4.962510	-0.5	0.07

Source: author's own research using Eviews software.

The results of the econometric model presented in *Table 9* represent the forecasted values of budgetary balance and money supply using as exogenous value the annual target value for the inflation rate. In case of decreasing the level of inflation rate with 0.5 percent each quarter as the previous quarter over the period of 2018: 2nd quarter – 2018 :4th quarter, the budgetary balance would increase with 4.96 percent in the last quarter of 2018, while for the value of money supply the increase would not be so significant, namely 0.07 percent.

Conclusion

The main object of this study was to reveal the impact of fiscal policy and monetary policy on the evolution of inflation. The empirical study explained the causality and variance between budgetary balance, inflation rate and money supply over the period of 2007 (1st quarter) – 2017 (4th quarter) on the case of Romania. These macroeconomic variables are significant for the improvement of any policy and strategy implemented by each state in order to stabilize the level of prices on the market. In order to adjust the effects of a high inflation, public authorities should implement sustainable monetary and fiscal policies. Empirical studies have revealed that any increase in the level of prices could be adjusted by public authorities by implementing new policies on the system of taxation or in the components of public spending. Most empirical findings revealed that increasing taxes would lead to a decrease in the level of disposable income which further contributes to a decrease in consumption and further on with consequences on inflation rate.

In case of Romania, the VECM model implemented revealed the existence of cointegrating number of vectors between the endogenous variables inflation rate, money supply and budgetary balance. Due to this fact, a long-run relationship could be developed and explained when taking into consideration the endogenous variables used on the development of the analyzed VECM model. The results of the economic model revealed that 82.11% in the evolution of inflation could be explained by the evolution in time of variable money supply or of the variable budgetary balance. The variance decomposition of 10 periods determined the fact that the variance of inflation rate could be explained at a maximum level of 38.10% while the money supply had an insignificant influence of only 3.97% at the period 7. As a consequence of implementing this model on the case of Romania, it was revealed that budgetary balance has a higher impact on the evolution of inflation rate than the evolution of money supply. Furthermore, the Granger Causality test revealed unidirectional causality forms from budgetary balance to inflation, from budgetary balance to money supply and from money supply to inflation. This indicated that any increase in the level of budgetary balance would consist in an increase in the level of inflation rate and of money supply. No bidirectional

causality form was released on the analyzed VECM model. Using scenarios on the analyzed VECM model, it was generated that in case of a prediction of the budgetary balance and money supply assuming that the inflation rate would decrease with 0.5% each predicted quarter, the budgetary balance and money supply would increase. The increase would be more significant in case of budgetary balance than in case of money supply. The results of the analyzed VECM model revealed that the inflationary tendency from the last years could be removed by implementing sustainable fiscal policies than to adjust the level of money supply.

References

Agbonlahor, O. (2014). The impact of monetary policy on the economy of the United Kingdom: A Vector Error Correction Model (VECM). *European Scientific Journal*, June, 10(16).

Blanchard, O., & Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *Quarterly Journal of Economics*, 117, 1329–1368.

Boiciuc, I. (2015). The effects of Fiscal Shocks in Romania. A SVAR Approach. *Procedia Economics and Finance*, 32, 1131-1139.

Brooks, Ch. (2014). *Introductory Econometrics for Finance*, 3rd Edition, Cambridge University Press.

Cheung, K.I., & Cheung, L. (1993). *The relative effectiveness of fiscal and monetary policy on inflation and unemployment: The Australian experience*. Department of Economics, University of Wollongong, Working Paper 93-1, 11. Retrieved from http://ro.uow.edu.au/commwkpapers/282 .

De Castro Fernández, F., & Hernández de Cos, P., (2006). The economic effects of exogenous fiscal shocks in Spain: a SVAR approach. *ECB Working Paper*, vol. 647. Frankfurt: European Central Bank.

Enders, W. (2004). Applied Econometric Time Series Second Edition, Wiley.

Eurostat database (2017). Data Explorer retrieved from http://ec.europa.eu/eurostat.

Georgantopoulos, A., & Tsamis, A. (2011). The Macroeconomic Effects of Budget Deficits in Greece: A VAR-VECM Approach. *International Research Journal of Finance and Economics*, 79(.

Giordano, R., Momigliano, S., Neri, S., & Perotti, R. (2007). The effects of fiscal policy in Italy: Evidence from a VAR model, *European Journal of Political Economy*, 23(3), 707-733.

Greene, W. (2000). *Econometric Analysis*, 4th Edition, Prentice Hall International.

Guraji, D. (2004). *Basic Econometrics*, 4th Edition, New York, NY: McGrow Hill.

Hamilton, J. (1994). *Time Series Analysis*, Princeton University Press.

Lutkepohl, H., & Mekus K. (2004). *Applied Time Series Econometrics*, Cambridge University Press.

National Bank of Romania. http://www.bnr.ro/Home.aspx accessed June 2018.

National Institute of Statistics – Romania. http://www.insse.ro/cms/ro accessed June 2018.