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FISCAL AND MONETARY DETERMINANTS OF THE EURO AREA'S GROWTH AND CYCLICAL RECURRENCE

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Abstract

The objective of this article is to study the opportunities for managing economic growth and business cycle in the Economic and Monetary Union. The fiscal and monetary determinants of growth and cyclical recurrence in the Euro Area, their size and impact direction have been identified by a vector autoregression. Recommendations have been made on macroeconomic policies, which stimulate growth and smooth out cyclical fluctuations in the Euro area.

Keywords: *Euro area, economic growth, business cycle, fiscal policy, monetary policy, vector autoregression*

JEL Codes: *E32, E52, E62, F43, 047*

Introduction

The Economic and Monetary Union (EMU) is not fully operational yet. Despite the considerable improvement of the design and architecture of the Euro Area (EA) over the last years, the lack of a common fiscal policy and the incomplete mandate of the European Central Bank (ECB) - focused only on price stability, but not on full employment, severely limits the options of policymakers to stimulate growth and smooth out the business cycle.

Macroeconomic policies in the EA are broadly discussed in economic literature (Franks et al., 2018; Jarociński and Maćkowiak, 2017; Orphanides, 2017; Vijselaar, 2000; Mooslechner, 2017; Neck and Haber, 2007; OECD, 2014; Hein and Detzer, 2015; Kamps, 2017 and many others).

The goal of this research is to analyze the opportunities for managing growth and cyclical recurrence in the EMU. It has been achieved through the fulfilment of the following tasks:

- Identification of the fiscal and monetary factors of the EA's economic growth (Section two);
- Identification of the fiscal and monetary determinants of the EMU's business cycle (Section three);
- Formulation of recommendations on fiscal and monetary policies, which stimulate growth and smooth out cyclical fluctuations in the EA (Conclusions section).

The methods of the vector autoregression (VAR) and the Hodrick-Prescott filter (HPF) are employed in the study. Quarterly seasonally adjusted Eurostat data for the period from the first quarter of 2002 to the fourth quarter of 2017 are used. All indicators are calculated as a percentage of actual real Gross Domestic Product (GDP), except for the output gap, which is calculated as a percentage of potential real GDP. Potential output is estimated using a HPF.

All variables are tested for stationarity. If it is found that they are integrated of the first order, tests are made for the optimal number of lags and co-integration of Johansen. The optimal number of lags is used in the Johansen co-integration test and later in the construction of the VAR. If the Johansen test demonstrates a co-integration connection between variables, a restricted VAR, also known as a Vector Error Correction (VEC), is applied. Otherwise, an unrestricted VAR is employed.

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The short-term cause-and-effect relationships between the variables are analyzed via the Pairwise Granger Causality Tests, and long-term causal links through the Granger Causality / Block Exogeneity Wald Tests. Impulse Response charts are produced to show how the target variables (the real GDP growth rate and the output gap) respond to fiscal and monetary shocks.

1. Fiscal and monetary factors of economic growth in the EA

The fiscal and monetary determinants of the EA's economic growth have been identified by vector autoregression, in which participate the following variables: **GDPGR** – growth rate of real GDP on the previous year; **FISC_BAL** – fiscal balance; **GOV_DEBT** – government debt; **GOV_EXP** – government expenditure; **GOV_REV** – government revenue; **INT_RATE –** interest rate on the main refinancing operations of the ECB; **MRR** – minimum reserve requirements. The target variable is **GDPGR**.

Table no. 1 – Group unit root test on the level values of variables

Method	Statistic	Prob.**	Cross sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.37082	0.3554	7	434
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.02609	0.5104	7	434
ADF - Fisher Chi-square	14.0221	0.4481	7	434
PP - Fisher Chi-square	14.2168	0.4337	7	441

Source: Prepared by the author

Table no. 2 - Group unit root test on the first differences of variables

Method	Statistic	Prob.**	Cross sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-15.0135	0.0000	6	367
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-13.9083	0.0000	6	367
ADF - Fisher Chi-square	160.433	0.0000	6	367
PP - Fisher Chi-square	205.402	0.0000	6	372

Source: Prepared by the author

The group unit root tests (see Tables 1 and 2) indicate that variables are integrated of order 1. The optimal lag-length for the Johansen co-integration test and for the VAR estimation is one lag (see Table 3). The Johansen co-integration test shows that variables are co-integrated and there are five co-integrating equations, therefore a restricted VAR (a Vector Error Correction) is applied.

Table no. 3 - VAR Lag Order Selection Criteria

Lag	Schwarz information criterion
0	11.55068
1	2.346009*
2	4.217308
3	5.634153
4	7.164394
5	6.297604

** indicates lag order selected by the criterion*

Source: Prepared by the author

The equation for the target variable **GDPGR** in the vector error correctionmodel after the removal of the statistically insignificant variables is

(1)D(GDPGR) = -0.45*(GDPGR(-1) + 0.06*INT_RATE(-1) - 0.35*MRR(-1) + 0.15) + 0.71*(FISC_BAL(-1) + 0.13*INT_RATE(-1) + 0.08*MRR(-1) + 2.58) - 0.08*(GOV_DEBT(-1) + 5.71*INT_RATE(-1) + 11.10*MRR(-1) - 106.44) + 0.71*(GOV_EXP(-1) - 0.14*INT_RATE(-1) + 2.45*MRR(-1) - 51.83) - 0.40*D(FISC_BAL(-1)) - 0.45*D(GOV_EXP(-1)) + 0.02

The first four terms in Equation (1) are error correction terms, which show long-run relationships between the dependent variable and the independent variables. The regression coefficients before the first and the third term are negative and indicate the speed at which the deviations from the long-run equilibrium between the dependent variable andthe independent variables in the error terms are eliminated. The value of -0.45 of the first coefficient means that 45% of the deviation from the equilibrium between **D(GDPGR), GDPGR(-1), INT_RATE(-1)** and **MRR(-1)** are eliminated for one period (quarter). The value of -0.08 of the third coefficient implies that 8% of the deviation from the equilibrium between **D(GDPGR), GOV_DEBT(-1), INT_RATE(-1)** and **MRR(-1)** are corrected for one period (quarter).

The second and the fourth coefficients are positive and show the rate per period, at which a deviation from the long-term equilibrium will increase. The value of 0.71 of the second coefficient suggests that the deviations from the long-run equilibrium between **D(GDPGR), FISC_BAL(-1), INT_RATE(-1)** and **MRR(-1)** will grow by71% per period. The value of 0.71 of the fourth coefficient implies that the deviations from the long-run equilibrium between **D(GDPGR), GOV_EXP(-1), INT_RATE(-1) and MRR(-1)** will rise by71% per period.

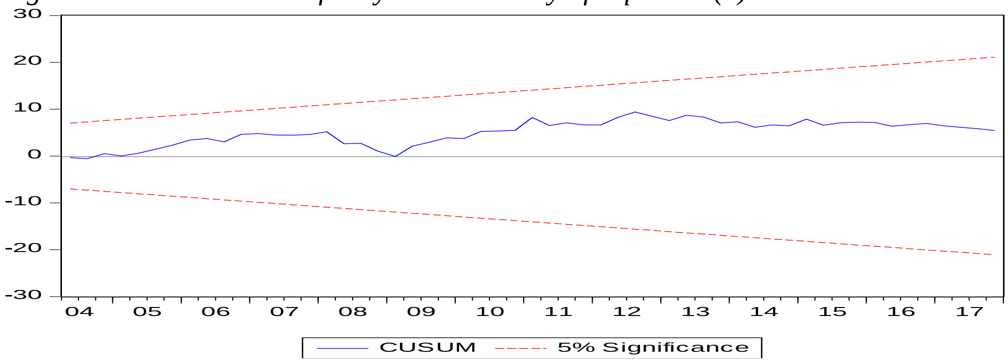
The fifth and the sixth terms are short-run. The value of the fifth regression coefficient (-0.40) means that in the short term 1% change in **D(FISC_BAL(-1))** will lead to a 0.40% change in **D(GDPGR)** in the opposite direction, if all other variables are held constant. The value of the sixth regression coefficient (-0.45) means that in the short run 1% change in **D(GOV_EXP(-1))** will cause a 0.45% change in **D(GDPGR)** in the opposite direction, if all other variables remain unchanged. The seventh coefficient is the constant, which has a value of 0.02.

The value of the coefficient of determination (0.49) shows that 49% of the changes in the EA economic growth can be explained by changes in the explanatory variable participating in Equation (1). The probability of the F-statistic (0.00) indicates that the alternative hypothesis of the adequacy of the regression model is accepted. The acceptance of the alternative hypothesis does not mean that the model specification is the best possible but only that the regression model adequately reflects the relationship between dependent variable and independent variables.

The serial correlation LM test (Chi-square probability of 0.0414) confirmed the zero hypothesis of the absence of a serial correlation of residuals at the 1% significance level. The residual heteroscedasticity test (Chi-square probability of 0.0430) confirmed the null hypothesis of the absence of heteroscedasticity in Equation (1) at the 1% significance level. The requirement of normal residual distribution is observed in Equation (1). The probability of the Jarque-Bera statistic is 0.69, which gives reason to accept the zero hypothesis of a normal residual distribution. The CUSUM Test indicates that Equation (1) is dynamically stable since all CUSUM values are located in the 5% significance interval (see Figure 1).

In the long term the EA's economic growth is correlated with its own past values and the lagged values of fiscal balance, government debt, government expenditure, minimum reserve requirements and ECB's interest rate. In the short run economic growth in the EMU is inversely related to the values of fiscal balance and government expenditure from the previous period.

Figure no. 1 CUSUM Test for dynamic stability of Equation (1)



Source: Prepared by the author

The Pairwise Granger Causality Tests indicate that in short period there is a causal link from the ECB's interest rate to the economic growth in the EA (see Table 4) and from the growth rate of real GDP to fiscal balance, government debt, government expenditure and the ECB interest rate (see Table 5).

Table no. 4 - Short-term causality from fiscal and monetary variables to GDPGR

Variable	Probability
FISC_BAL	0.29
GOV_DEBT	0.48
GOV_EXP	0.21
GOV_REV	0.69
INT_RATE	0.03
MRR	0.64

Source: Prepared by the author

Table no. 5 - Short-term causality from GDPGR to fiscal and monetary variables

Variable	Probability
FISC_BAL	0.00
GOV_DEBT	0.00
GOV_EXP	0.00
GOV_REV	0.43
INT_RATE	0.00
MRR	0.29

Source: Prepared by the author

The Granger Causality/Block Exogeneity Wald Tests show that in the long run there are no causal links from the fiscal and monetary variables to the real GDP growth rate (see Table 6), but economic growth causes fiscal balance and government expenditure (see Table 7).

Table no. 6:-Long-term causality from fiscal and monetary variables to D(GDPGR)

Variable	Probability
D(FISC_BAL)	0.3380
D(GOV_DEBT)	0.3581
D(GOV_EXP)	0.3238
D(GOV_REV)	0.7079
D(INT_RATE)	0.2420
D(MRR)	0.1145

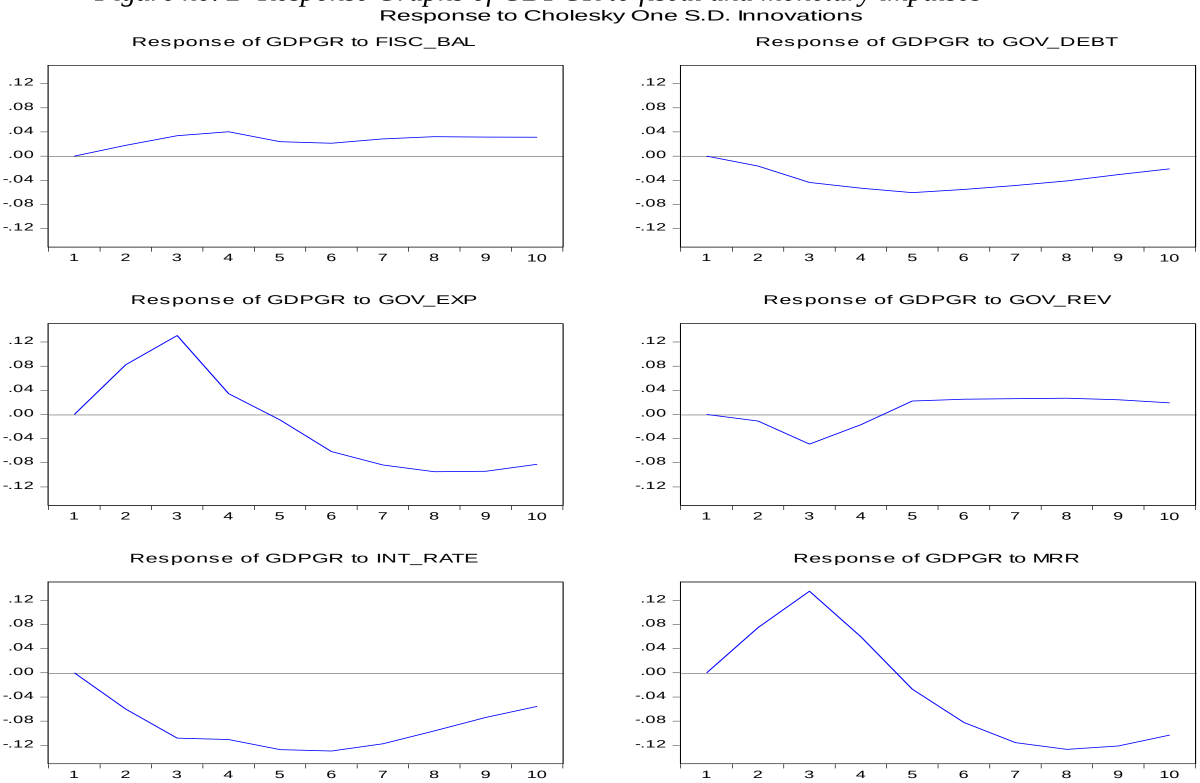
Source: Prepared by the author

Table no. 7: Long-term causality from D(GDPGR) to fiscal and monetary variables

Variable	Probability
D(FISC_BAL)	0.0258
D(GOV_DEBT)	0.6336
D(GOV_EXP)	0.0114
D(GOV_REV)	0.9499
D(INT_RATE)	0.1900
D(MRR)	0.7342

Source: Prepared by the author

Figure no. 2- Response Graphs of GDPGR to fiscal and monetary impulses



Source: Prepared by the author

The response of the EA economic growth to fiscal and monetary changes is shown on Figure 2.

2. Fiscal and monetary determinants of the EMU's business cycle

The fiscal and monetary determinants of the EA's business cycle have been identified by vector autoregression, in which participate the following variables: **GAP** – output gap; **FISC_BAL** – fiscal balance; **GOV_DEBT** – government debt; **GOV_EXP** – government expenditure; **GOV_REV** – government revenue; **INT_RATE –** interest rate on the main refinancing operations of the ECB; **MRR** – minimum reserve requirements. The target variable is **GAP**.

Table no. 8 - Group unit root test on the level values of variables

Method	Statistic	Prob.**	Cross sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.61420	0.2695	7	433
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.19662	0.4221	7	433
ADF - Fisher Chi-square	16.9497	0.2589	7	433
PP - Fisher Chi-square	10.3654	0.7350	7	441

Source: Prepared by the author

Table no. 9 - Group unit root test on the first differences of variables

Method	Statistic	Prob.**	Cross sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-11.6322	0.0000	6	367
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-11.6969	0.0000	6	367
ADF - Fisher Chi-square	128.393	0.0000	6	367
PP - Fisher Chi-square	171.696	0.0000	6	372

Source: Prepared by the author

The group unit root tests (see Tables 8 and 9) indicate that variables are integrated of order 1. The optimal lag-length for the Johansen co-integration test and for the VAR estimation is one lag (see Table 10). The Johansen co-integration test shows that variables are co-integrated and there are two co-integrating equations, therefore a restricted VAR (a Vector Error Correction) is applied.

Table no. 10 - VAR Lag Order Selection Criteria

Lag	Schwarz information criterion
0	12.04036
1	2.961724*
2	4.299850
3	5.862472
4	7.352484
5	6.498944

** indicates lag order selected by the criterion*

Source: Prepared by the author

The equation for the target variable **GAP** in the vector error correctionmodel after the removal of the statistically insignificant variables is

(2)D(GAP) = 0.10*(GAP(-1) - 0.99*GOV_DEBT(-1) + 0.89*GOV_EXP(-1) + 8.70*GOV_REV(-1) - 4.85*INT_RATE(-1) + 11.80*MRR(-1) - 368.35) + 0.50*D(GAP(-1)) - 0.45*D(FISC_BAL(-1)) - 0.56*D(GOV_EXP(-1)) + 0.02

The first term in Equation (2) is an error correction term, which shows a long-run relationship between the dependent variable and the independent variables. The regression coefficient before the first term is positive and shows the rate per period, at which a deviation from the long-term equilibrium will increase. The value of 0.10 of the first coefficient suggests that the deviations from the long-run equilibrium between **D(GAP), GAP(-1), GOV_DEBT(-**

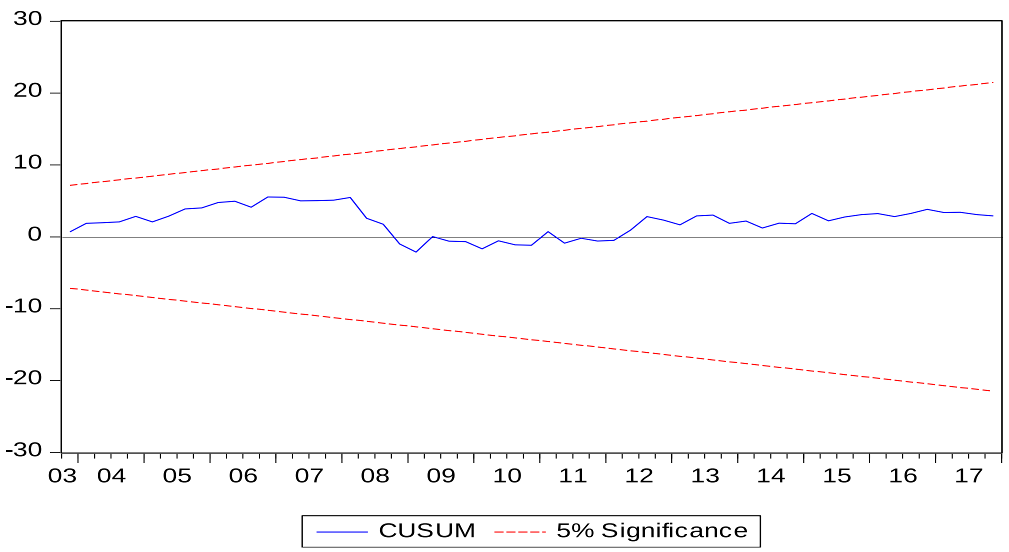
1), GOV_EXP(-1), GOV_REV(-1), INT_RATE(-1) and **MRR(-1)** will grow by10% per period.

The second, the third and the fourth terms are short-run. The value of the second regression coefficient (0.50) means that in the short term 1% change in **D(GAP(-1))** will lead to a 0.50% change in **D(GAP)** in the same direction, if all other variables are held constant. The value of the third regression coefficient (-0.45) means that in the short run 1% change in **D(FISC_BAL(-1))** will cause a 0.45% change in **D(GDPGR)** in the opposite direction, if all other variables remain unchanged. The value of the fourth regression coefficient (-0.56) means that in the short term 1% change in **D(GOV_EXP(-1))** will lead to a 0.56% change in **D(GAP)** in the opposite direction, if all other variables remain unchanged. The fifth coefficient is the constant, which has a value of 0.02.

The value of the coefficient of determination (0.55) shows that 55% of the changes in the EA output gap can be explained by changes in the explanatory variable participating in Equation (2). The probability of the F-statistic (0.00) indicates that the alternative hypothesis of the adequacy of the regression model is accepted. The acceptance of the alternative hypothesis does not mean that the model specification is the best possible but only that the regression model adequately reflects the relationship between dependent variable and independent variables.

The serial correlation LM test (Chi-square probability of 0.2017) confirmed the zero hypothesis of the absence of a serial correlation of residuals. The residual heteroscedasticity test (Chi-square probability of 0.0618) confirmed the null hypothesis of the absence of heteroscedasticity in Equation (1) at the 5% significance level. The requirement of normal residual distribution is observed in Equation (2). The probability of the Jarque-Bera statistic is 0.03, which gives reason to accept the zero hypothesis of a normal residual distribution at the 1% level. The CUSUM Test indicates that Equation (2) is dynamically stable since all CUSUM values are located in the 5% significance interval (see Figure 3).

Figure no. 3: CUSUM Test for dynamic stability of Equation (2)



Source: Prepared by the author

In the long term the EA's output gap is correlated with its own past values and the lagged values of government debt, government expenditure, government revenue, minimum reserve requirements and ECB's interest rate. In the short run the output gap in the EMU is related positively to its own past values and negatively to the values of fiscal balance and government expenditure from the previous period.

The Pairwise Granger Causality Tests indicate that in short period there is a causal link from the ECB's interest rate to the output gap in the EA (see Table 11) and from the output gap to government debt and the ECB interest rate (see Table 12).

Table no. 11 - Short-term causality from fiscal and monetary variables to GAP

Variable	**Probability**
FISC_BAL	0.61
GOV_DEBT	0.43
GOV_EXP	0.71
GOV_REV	0.84
INT_RATE	0.06
MRR	0.99

Source: Prepared by the author

Table no. 12 - Short-term causality from GAP to fiscal and monetary variables

Variable	**Probability**
FISC_BAL	0.83
GOV_DEBT	0.04
GOV_EXP	0.53
GOV_REV	0.73
INT_RATE	0.05
MRR	0.64

Source: Prepared by the author

The Granger Causality/Block Exogeneity Wald Tests show that in the long run there are no causal links from the fiscal and monetary variables to the output gap (see Table 13), but the output gap causes the ECB interest rate (see Table 14).

Table no. 13 - Long-term causality from fiscal and monetary variables to D(GAP)

Variable	**Probability**
D(FISC_BAL)	0.3758
D(GOV_DEBT)	0.3407
D(GOV_EXP)	0.3088
D(GOV_REV)	0.7827
D(INT_RATE)	0.3953
D(MRR)	0.1319

Source: Prepared by the author

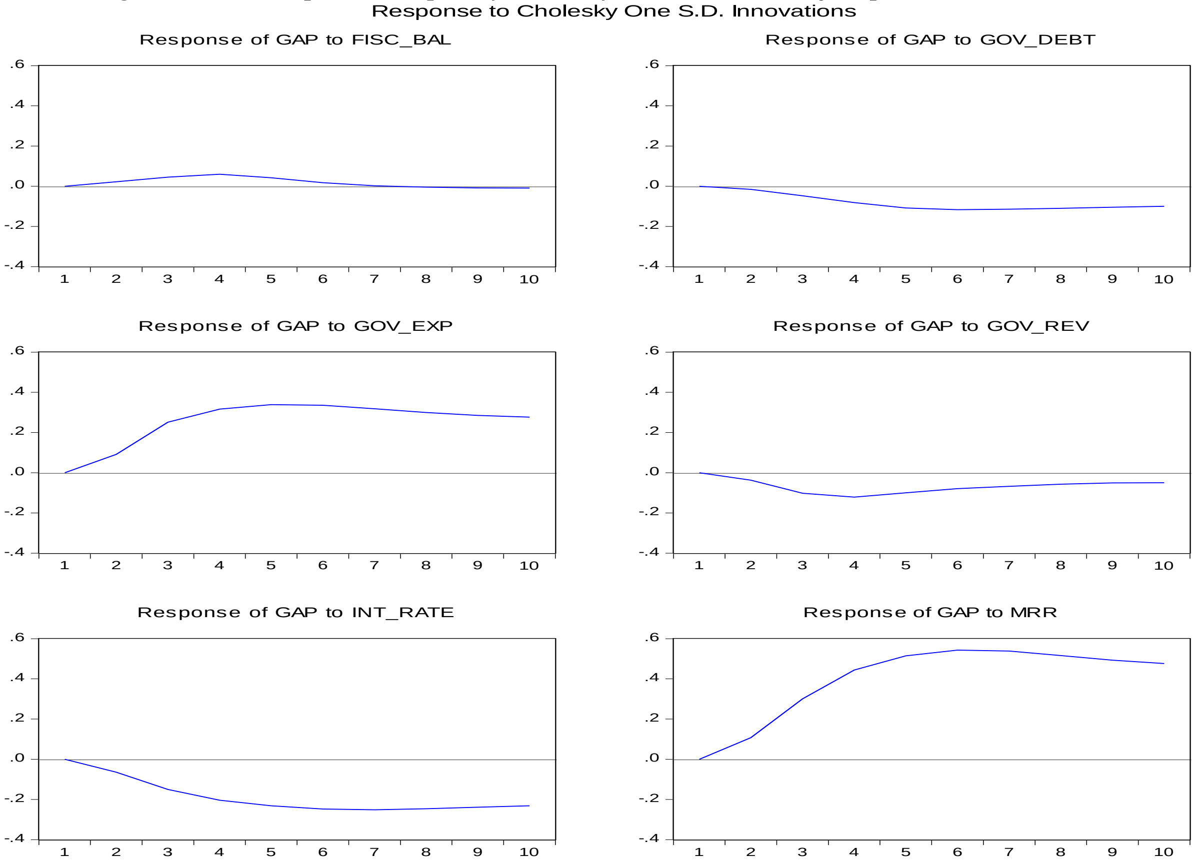
Table no. 14 - Long-term causality from D(GAP) to fiscal and monetary variables

Variable	**Probability**
D(FISC_BAL)	0.3254
D(GOV_DEBT)	0.6488
D(GOV_EXP)	0.1775
D(GOV_REV)	0.7614
D(INT_RATE)	0.0019
D(MRR)	0.3499

Source: Prepared by the author

The response of the EA output gap to fiscal and monetary changes is shown on Figure 4.

Figure no. 4 - Response Graphs of GAP to fiscal and monetary impulses



Source: Prepared by the author

Conclusion and Recommendations

There are four long-term relationships between economic growth, fiscal and monetary policy in the EMU. Two of these links are equilibria (the first and the third term of Equation (1)) and two are disequilibria (the second and the fourth term of Equation (1)). In the long-run fiscal and monetary policy do not cause the growth rate of real GDP (see Table 6), but economic growth causes fiscal variables (see Table 7).

In the short term the real GDP growth rate in the EA can be increased by lowering the share of government expenditure in GDP (see the sixth regression coefficient in Equation (1)). There are short-run causalities from monetary policy to economic growth (see Table 4) and from economic growth to fiscal and monetary parameters (see Table 5).

A long-term disequilibrium relationship exists between output gap, fiscal and monetary policy in the EMU (see the first term of Equation (2)). In the long-run fiscal and monetary policy do not cause the GDP gap (see Table 13), but the output gap causes interest rates (see Table 14).

In the short term the cyclical fluctuations in the EA can be counteracted by changing the share of government expenditure in GDP (see the fourth regression coefficient in Equation (2)). The negative value of this coefficient suggests that decreasing the share of government expenditure in GDP may help avoid a recession, and increasing this share may prevent an overheating of the economy. There are short-run causalities from monetary policy to the business cycle (see Table 11) and from the business cycle to government debt and the ECB interest rate (see Table 12).

The empirical results in this study confirm the expectations of economic theory that in the long run fiscal and monetary policies are neutral (do not cause economic growth and cyclical fluctuation). In the short term fiscal consolidation (reducing the share of government expenditure in GDP) may be used to stimulate growth and overcome a recessionary gap.

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