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Empirical Analyses of the Relationship between Trade and Budget Deficit of FYR of Macedonia

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Abstract

The purpose of this article is to analyze the evidence of twin deficits hypothesis by empirically examining the relationship between trade deficit and budget deficit for the case of FYR of Macedonia. The study employs a vector autoregression (VAR) model as well as a Granger causality test in order to investigate the causal relationship between trade and budget deficit variables using quarterly data for the time period 1998Q1–2017Q4. The econometric results of VAR model disclose that there exists a short term relationship between these two variables, implying that higher trade deficits are associated with higher fiscal deficits. Moreover, the causality test shows a unidirectional relationship, revealing that trade deficit causes budget deficit, whereas budget deficit doesn't cause trade deficit.

Keywords: trade deficit, budget deficit, causality analysis

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1. Introduction

Since the first decade of transition, FYR of Macedonia has been characterized by soaring deficits of current account and foreign trade, whereas the government budget deficit has been moderate, except in the periods of external shocks and internal political problems in the last few years, resulting in an average budget deficit of 3.2 percent of GDP, in the period 2009-2017. In general, the budget deficit and the trade and/or current account deficits are considered as major macroeconomic concerns in any economy, so the large external deficits tend to threat the macroeconomic stability of a country, both in short and long term. Thus, the persistence of budget deficit and external balances show the need for a proper investigation of their relationship for the case of FYR of Macedonia, thereby this study attempts to provide such an empirical

analysis. The paper examines any cointegrating or long-run relationship between the two deficits, and it inspects if any causal relationship or short-run relationship exists between the variables for policy measurements and implications.

In the last few decades, the inspection of the correlation amongst budget and trade deficits has fuelled a lot of debate among scholars and policymakers, especially for the U.S economy. Many economists deduce that these two macroeconomic parameters are causally related, revealing that a sound fiscal policy leads to shrinking of trade deficit. The most prominent viewpoint, also referred to as the twin deficit hypothesis, is that of Keynesian view, whereas the other famous theory is the Ricardian Equivalence hypothesis. The former suggests there is a positive relationship between budget deficit and trade deficit, as well as there exists a unidirectional Granger causality that runs from budget deficit to trade deficit. Unlike Keynesian view, Ricardian Equivalence hypothesis supports the idea that there is no relationship between budget deficit and trade deficit, subsequently they are independent.

In the Graph 1 below are displayed the movements of deficits in FYR of Macedonia in quarterly basis from 1998 to 2017. However, it is difficult to conclude about their relationship from this graph. Although it can be observed that in some of periods they move in the same direction.
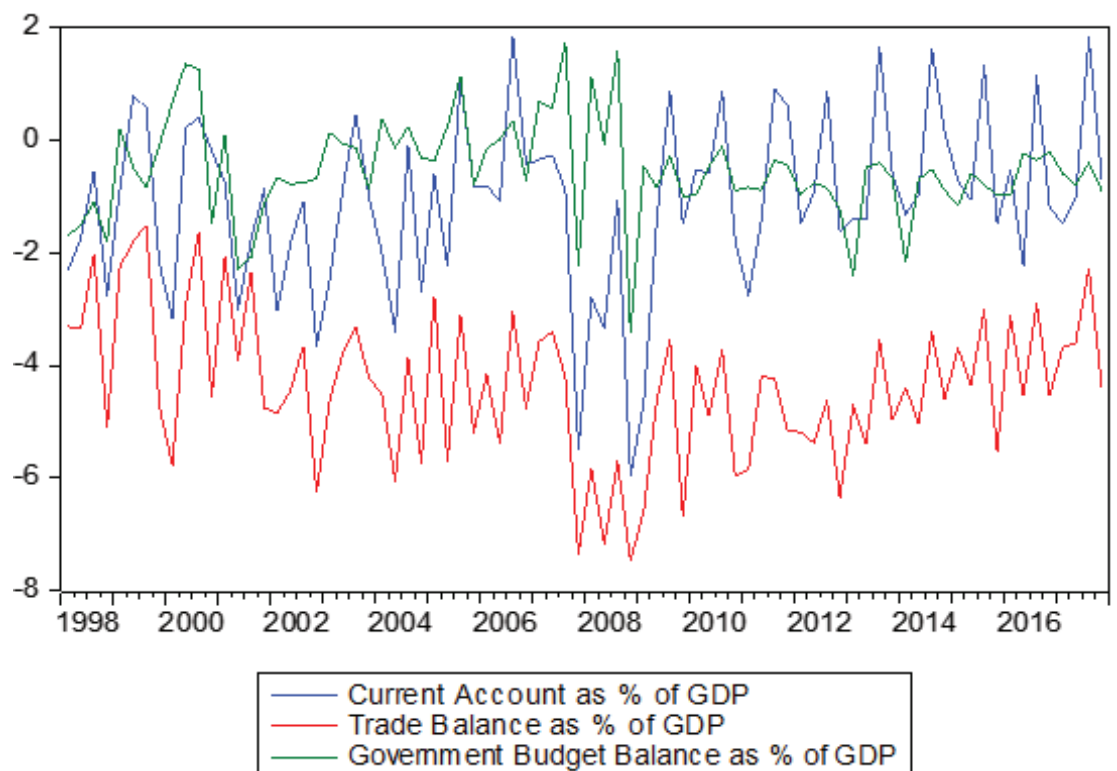

Figure 1: Government Budget Balance and Trade Balance. Source: Ministry of Finance and National Bank of FYROM.

2. Brief Empirical Literature Review

There is a large body of empirical literature that examine the relationship between budget deficit and trade deficit (or current account deficit). Yet, the findings are assorted for both developed and developing countries and their connection remains controversial. Thorough elaborations in support of Keynesian hypothesis of the twin deficit, that the budget deficit causes the trade deficit, include among others the research conducted by [13, 20, 23, 29, 30, 32, 33]. While several other authors find a causal link that goes from current account or trade deficit to budget deficit [3, 21, 31]. Also, there exist a wide collection of studies that find a bi-directional causality between both deficits [4, 14, 24, 25, 27]. At last, other inquiries validate the Ricardian equivalence hypothesis of non causality between the two deficits [8, 11, 16, 22, 26].

The twin deficits hypothesis started to draw researchers' attention during the "Reagan fiscal audition" in the 1980s, in plain sight period of strong appreciation of the dollar with unusual rise in current account deficits. Some earlier studies on twin deficit phenomenon are principally focused on the interrelationships and/or co-moving relation in a bi-variate framework between budget deficit and trade balance (or current account balance). In this regard, [9] using U.S quarterly data for the time period 1960-1984, shows the existence of bi-directional causality between the government deficit and the trade deficit during the period of floating exchange rates. Based on [9] analysis this indicates that policy makers of U.S. may have responded with added government spending because of domestic hardship caused by the trade deficit. Also, [19] find a bi-directional causality between budget deficit and trade deficit for Brazil for the period 1973-1991. [1] estimates a vector autoregressive (VAR) model with several relevant explanatory variables and he finds that budget deficit influences trade deficit indirectly rather than directly. He supports the twin deficit hypothesis and his evidence suggests that the twin deficits are connected through the transmission mechanisms of interest rates and exchange rates.

[7] examines time series data for six countries and reveals a robust and significant link between fiscal policy and trade deficits. Accordingly, for the United States, Canada, the United Kingdom, and West Germany, a $1 increase in the budget deficit is associated with roughly a $0.30 decline in the current account surplus.

Though, [32] analyzed the relationship between budget deficit and foreign trade deficit of Greece for the period 1948 – 1994. He finds that there is a unidirectional causality from budget deficit towards foreign trade deficit in both short and long term.

[5] analyzed the fiscal and current account balances in OECD countries for the period 1990-2005 and found that the changes in fiscal and current account balances settle with the predictions of the twin deficit view. Another study by [30] examined this issue for US, Japan, Germany, Britain, France, Italy and Canada for the period 1973 – 2005. According to his results, there is a strong evidence for a direct relation between budget deficit and current account deficit, but the relation is delayed. Also, [2] support the Keynesian view that there is a long-run relationship between budget deficit and current account imbalances for Turkey.

Moreover, a range of studies that analyzed the underlined issue didn't find any causal relationship between budget and trade deficit. Thus, the empirical studies of [22] for United States, [11] for United States, [12] for Canada, [16] for Austria, [18] for Turkey find supportive evidence of the Ricardian equivalence hypothesis, in which both deficits are not correlated. For instance, [11] develop a two country micro-theoretic model consistent with the Ricardian equivalence hypothesis. Their findings show that budget deficit does not cause the current account deficit. [6] employs a VAR model and examined the factors affecting the trade balance of the United States over the quarterly basis for period 1976 – 1995. He finds neither direct nor indirect effect of federal budget deficit on the trade deficit. Besides above studies there exist plenty of other researches with diverse findings and conclusions.

3. Methodology and Data

This part of the paper aims to estimate the relationship between budget deficit and trade deficit, as well as budget deficit and current account deficit in order to investigate the existence of twin deficit hypothesis for the case of FYR of Macedonia. For estimating their correlation, it will be used vector autoregression (VAR) methodology. Beside this will be performed a Granger Causality test for examining if is there any causal relationship between budget and trade deficits or not, as well as the direction of causality. The VAR models allow for the calculation of the so-called impulse responses and variance decompositions. The impulse response analysis informs us about the dynamic impact of certain variables, including their lagged values, on a given variable. The variance decomposition provides information about the percentage of variation of a given variable that can be explained by its own lagged values or other variables.

When estimating regression models using time series data it is necessary to know whether the variables are stationary or not (either around a level or a deterministic linear trend) in order to avoid spurious regression problems. So the first thing to do when performing the regression analysis is to check for spurious regression. When using non-stationary time series in a regression model one may gain apparently significant relationships from unrelated variables. This phenomenon known as spurious regression or 'non-sense regressions' occur when results from the model show promising diagnostic test statistics even where the regression analysis has no meaning [15]. To avoid this initial problem we check for the stationary of variables, using Dickey Fuller and Philips–Perron tests.

3.1. The data

The quarterly data are used in the empirical analysis, covering the period 1998Q1-2017Q4. The main sources of data are the National Bank (NBRM), Ministry of finance (MoF) and the State Statistical Office (SSO). The used variables in the analysis are presented in (Graph 2) below, whereas the variable description in (Table 1).
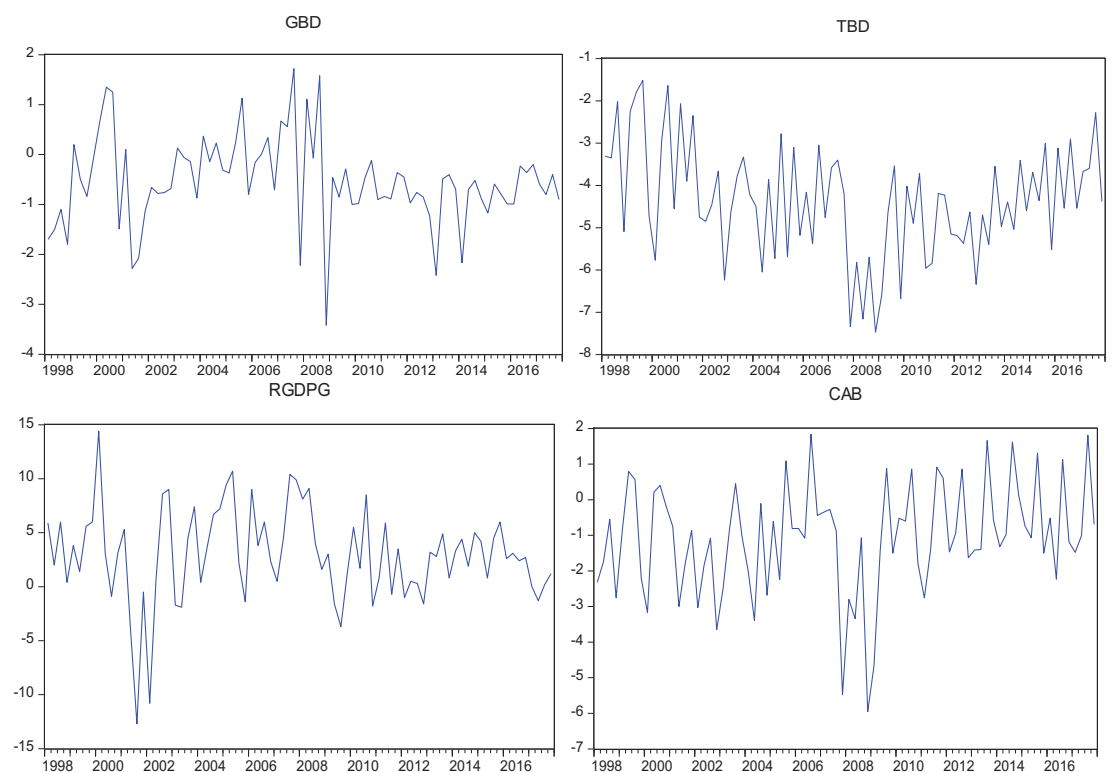

Figure 2: Used variables in the empirical analysis. Source: National Bank of RM and State Statistical Office of Macedonia.

TABLE 1: Description of data and data sources.

Variable	Abbreviation	Description	Source
Government budget balance	GBD	Government budget balance as % of GDP	NBRM MoF
Trade Balance	TBD	Trade Balance as % of GDP	NBRM
Current Account Balance	CAB	Current Account Balance as % of GDP	NBRM
GDP growth	RGDPG	Real GDP growth	SSO

The following table gives the summary statistics for the data used in the empirical analysis. In total there are 80 observations. The mean, the standard deviation and the minimum and maximum values of the data are summarized, for a better understanding of the data pattern. The mean of trade deficit, current account deficit and budget deficit are negative indicating the persistence of these deficits over the 1998-2017 period.

TABLE 2: Descriptive statistics.

Variable	Obs	Mean	Std.Dev	Min	Max
GBD	80	-0.53375	0.89836	-3.42	1.72
TBD	80	-4.39125	1.33107	-7.47	-1.52
CAB	80	-1.07338	1.59887	-5.95	1.84
RGDPG	80	2.94750	4.35329	-12.7	14.4

Source: Authors' calculation

3.2. The specification of econometric model

The econometric model of this research consists on a vector autoregressive (VAR) system, which is specified as following:

$$
\begin{bmatrix} GBD_t \\ TBD_t \\ RGDPG_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} + \begin{bmatrix} \Phi_{11}(L) & \Phi_{12}(L) & \Phi_{13}(L) \\ \Phi_{21}(L) & \Phi_{22}(L) & \Phi_{23}(L) \\ \Phi_{31}(L) & \Phi_{32}(L) & \Phi_{33}(L) \end{bmatrix} \begin{bmatrix} GBD_t \\ TBD_t \\ RGDP_t \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix}
$$

Where, *GBD*, *TBD* and *RGDPG* denote three potentially endogenous variables: government budget deficit, trade deficit and real GDP growth, respectively, *L* is the lag operator, and ε_{1t}, ε_{2t} and ε_{3t} are white noise errors. The null of no joint significance of parameters of lagged variables of interest can be tested using *F*–tests. Empirical analysis based on time series data assumes that the underlying time series are stationary.

However, many studies have shown that majority of time series variables are non stationary or integrated of order one [10]. Accordingly they should transform to stationary by taking the first or second difference.

4. Empirical Results

The analysis first starts with time series properties of the variables checked through Augmented Dickey-Fuller (ADF) and Philips-Perron unit root testing procedure. The results indicate that all series are stationary in their level, so there is no need for differencing them. When series are stationary, VAR system is an appropriate econometric examination for the analyzed series. The test results are summarized in Table 3 below.

TABLE 3: Unit root test statistics of series.

Variables	Test	Level		Decision
		t-statistics	p-value	
GBD	ADF	-3.149**	0.027	I(0)
	PP	-8.173***	0.000	
TBD	ADF	-3.821***	0.004	I(0)
	PP	-7.476***	0.000	
CAB	ADF	-3.185**	0.024	I(0)
	PP	-7.287***	0.000	
RGDPG	ADF	-6.228***	0.000	I(0)
	PP	-6.235***	0.000	

The notifications ***, ** and * denote 1%, 5% and 10% level of significance, respectively.

Source: Authors' calculations

As a general rule, non-stationary time series variables should not be used in regression models in order to avoid the problem of spurious regression. [10] pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination does exist, the non-stationary time series are said to be co-integrated and the stationary linear combination can be interpreted as a long run equilibrium relationship among the variables. Since all the variables used in our empirical analysis are stationary in levels according to ADF and PP results, the co-integration test is not necessary to be carried out, as two series being I(0) cannot be co-integrated.

In fact, there appears to be a positive relationship between budget deficit and trade deficit as well as between budget deficit and current account deficit of FYR of Macedonia (See Graph 3 Below). The lines represent the linear approximation to their relationship as determined by ordinary least squares (OLS) regression. The slope of the line between budget and trade deficit is 0.365 and is statistically significant at 5 percent level, which indicates that a 1 unit increase in the budget deficit is associated with a 0.365 units rise in the trade deficit. While the slope of the line between budget and current account deficit is 0.546 and is also statistically significant at 5 percent level.
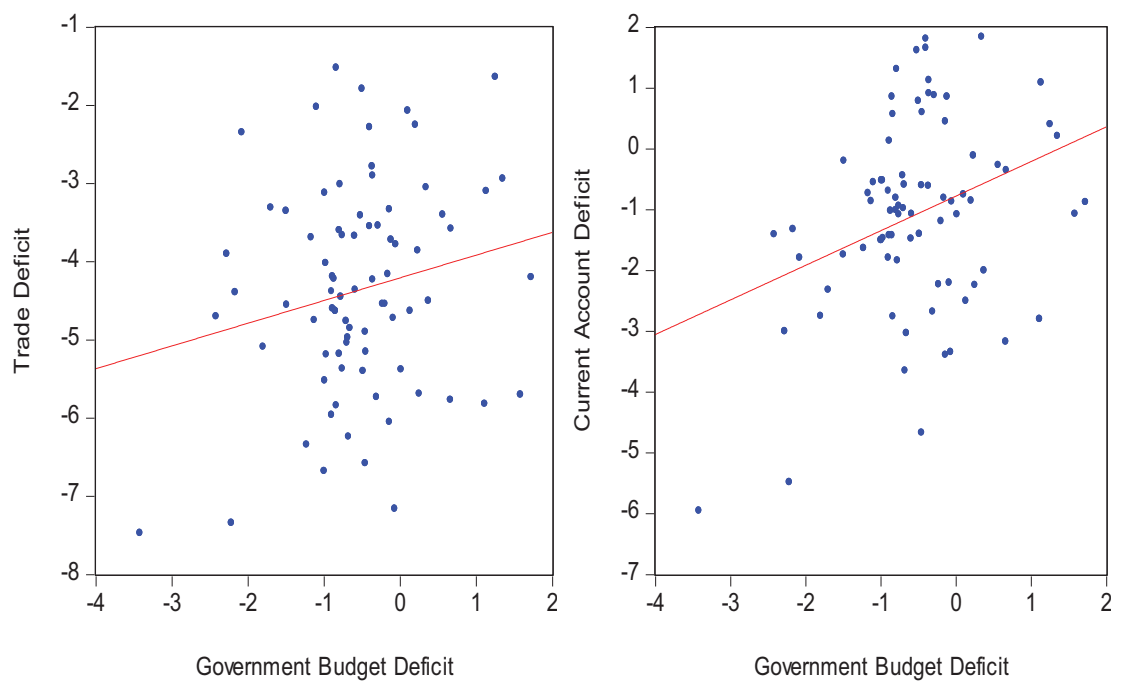

Figure 3: The Relationship between Budget Deficit and Trade and Current Account Deficit of FYR of Macedonia. **Source:** Author's calculation.

The following section presents the regression results of VAR model, impulse response functions and the causality test. According to Akaike Information Criterion (AIC), the optimal number of lags for the variables is 4. In Table 4 below are displayed the empirical results of VAR model. From it can be observed that none of the variables is statistically significant in explaining the trade deficit, but the impact of lagged values of the trade deficit on itself is significant, revealing its persistence. Yet, at the other equation, the variable of trade deficit is statistically significant in the fourth lag, meaning that trade deficit affects the budget deficit. Thus the results imply that the fiscal deficit doesn't affect the trade deficit. However, the trade deficit influences the budget deficit. The short-term relationship between the budget and trade deficit

is positive in the fourth lag and consequently higher trade deficits are associated with higher fiscal deficits.

The results of Granger causality test also reveal that fiscal deficit doesn't Granger cause the trade deficit, since the null hypothesis cannot be rejected (see Table 5). But the null hypothesis is rejected for the other direction, meaning that trade deficit cause the fiscal deficit. These results are in line with findings of [3, 21, 31] that find a unidirectional causal relationship that runs from trade deficit (or current account deficit) to budget deficit.

Concerning the impulse response functions displayed in Graph 4 below, can be observed that for one standard deviation shock given to government deficit, the response of trade deficit is very low or close to zero in all time horizon, except in the third period, meaning that the budget balance weakly reacts. On the other hand, for one standard deviation shock given to trade deficit, the budget deficit reacts positively in the fifth and ninth period, whereas at the other time horizon the line approaches to zero.

The variance decomposition provides further results. Nearly 17% of variations of the fiscal deficit can be explained by variations of the trade deficit. The rest is due to variations of lagged values of the fiscal deficit. While only 6% of variations of trade deficit can be explained due to variations of budget deficit.

TABLE 4: Results of VAR Model for the Relationship between Budget Balance and Trade Balance.

Vector Autoregression Estimates			
Sample (adjusted): 1999Q1 2017Q4			
Included observations: 76 after adjustments			
Standard errors in () & t-statistics in [ ]			
	TBD	GBD	RGDPG
TBD(-1)	0.164625	-0.057143	-0.271957
	(0.12091)	(0.08410)	(0.44294)
	[1.36150]	[-0.67945]	[-0.61399]
TBD(-2)	0.238490	-0.016619	0.207937
	(0.12085)	(0.08406)	(0.44272)
	[1.97337]	[-0.19770]	[0.46968]
TBD(-3)	-0.069129	0.088514	-0.252527
	(0.11981)	(0.08333)	(0.43888)
	[-0.57701]	[1.06220]	[-0.57540]
TBD(-4)	0.392209	0.158901	0.205833
	(0.11838)	(0.08234)	(0.43364)
	[3.31320]	[1.92987]	[0.47466]

GBD(-1)	-0.101260	-0.038851	0.400679
	(0.18148)	(0.12623)	(0.66481)
	[-0.55796]	[-0.30778]	[0.60270]
GBD(-2)	-0.205970	0.080369	1.082900
	(0.17536)	(0.12197)	(0.64238)
	[-1.17455]	[0.65892]	[1.68575]
GBD(-3)	-0.241686	-0.214421	1.126911
	(0.17388)	(0.12094)	(0.63695)
	[-1.38997]	[-1.77294]	[1.76922]
GBD(-4)	0.061904	0.162112	-1.025837
	(0.16944)	(0.11785)	(0.62070)
	[0.36534]	[1.37552]	[-1.65271]
RGDPG(-1)	-0.017086	0.056335	0.315291
	(0.03511)	(0.02442)	(0.12863)
	[-0.48659]	[2.30664]	[2.45118]
RGDPG(-2)	0.015095	0.017685	-0.089281
	(0.03570)	(0.02483)	(0.13079)
	[0.42279]	[0.71217]	[-0.68265]
RGDPG(-3)	0.032574	0.017012	-0.026719
	(0.03582)	(0.02491)	(0.13120)
	[0.90949]	[0.68292]	[-0.20365]
RGDPG(-4)	0.028563	0.019442	-0.058201
	(0.03481)	(0.02421)	(0.12753)
	[0.82043]	[0.80288]	[-0.45636]
C	-1.631944	-0.048332	2.814989
	(0.73262)	(0.50958)	(2.68377)
	[-2.22753]	[-0.09485]	[1.04890]
R-squared	0.372250	0.326071	0.246318
Adj. R-squared	0.252678	0.197704	0.102759
Sum sq. Resids	82.65364	39.98694	1109.144
S.E. equation	1.145409	0.796689	4.195886
F-statistic	3.113201	2.540142	1.715802
Log likelihood	-111.0285	-83.43647	-209.7025
Akaike AIC	3.263908	2.537802	5.860593
Schwarz SC	3.662586	2.936480	6.259271
Mean dependent	-4.407368	-0.481711	2.914474
S.D. dependent	1.324973	0.889450	4.429649
Source: Author's calculation			

TABLE 5: Granger Causality test.

Pairwise Granger Causality Tests			
Sample: 1998Q1 2017Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
GBD does not Granger Cause TBD	78	0.43352	0.6499
TBD does not Granger Cause GBD		3.25453	0.0513
RGDPG does not Granger Cause TBD	78	1.03811	0.3593
TBD does not Granger Cause RGDPG		0.52625	0.5930
RGDPG does not Granger Cause GBD	78	4.11705	0.0202
GBD does not Granger Cause RGDPG		1.63509	0.2020
Lags: 4			
Null Hypothesis:	Obs	F-Statistic	Prob.
GBD does not Granger Cause TBD	76	0.69877	0.5955
TBD does not Granger Cause GBD		4.69964	0.0224
RGDPG does not Granger Cause TBD	76	0.34804	0.8445
TBD does not Granger Cause RGDPG		0.30979	0.8705
RGDPG does not Granger Cause GBD	76	1.90909	0.1191
GBD does not Granger Cause RGDPG		2.29159	0.0686
Source: Author's calculation			

5. Conclusions

The purpose of this research paper was to shed light on the relationship between trade and budget deficit and investigating the twin deficit hypothesis for the case of FYR of Macedonia. For estimating their relationship, it has been used the quantitative research strategy, concretely the vector auto regression (VAR) methodology. Beside this it has been performed a Granger Causality test in order to be investigated if is there any causal relationship between aforementioned variables or not, as well as the direction of causality. The results of VAR model indicated that higher trade deficits are associated with higher fiscal deficits. Based on Granger causality test, the null hypothesis that budget deficit (GBD) does not Granger cause trade deficit (TBD) cannot be rejected, however the null hypothesis that trade deficit does not Granger cause fiscal deficit is rejected at 5 percent level. Accordingly, the results revealed that there is a unidirectional causal relationship that goes from trade deficit to fiscal deficit.
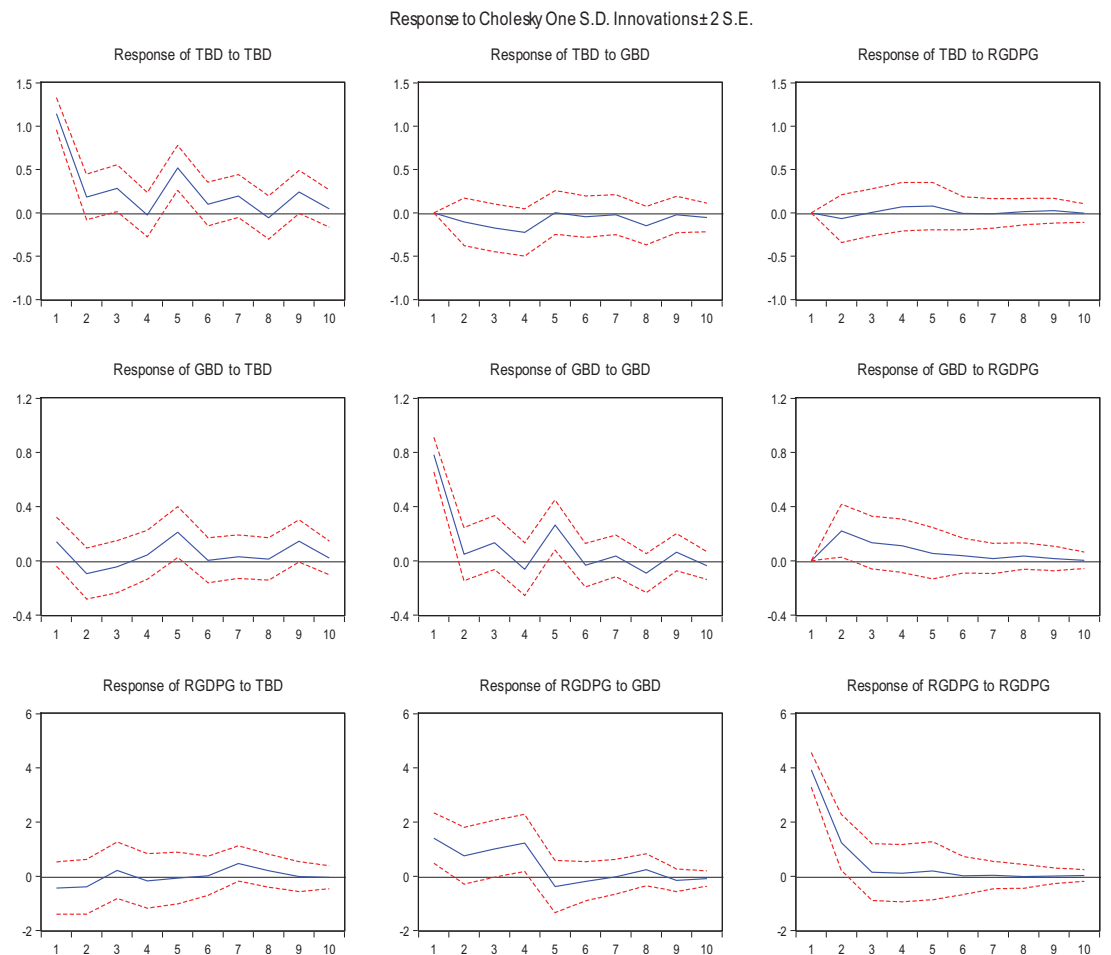
Figure 4: Impulse Response functions. Source: Author's calculation.

The policy implications of results of this paper are that the government should target export oriented firms that aim at expanding their businesses and encourage an import substitution industry by creating favorable business environments. The increase in export oriented firms and import substitutes in the home country will increase home production, employment and earnings which in turn boost export performance and reduce imports volume. These policies if effectively implemented will ultimately reduce budget deficits and improve the country's trade balance.

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