

TESTING FISCAL SUSTAINABILITY IN THE REPUBLIC OF MACEDONIA - A VAR APPROACH

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ABSTRACT

The recent global financial and economic crisis caused great concerns in many developed countries (especially in the European Union) due to rising debt levels and deterioration of their fiscal space. The adverse effects of high indebtedness highlighted the importance of maintaining sustainable public finances. This problem was not limited to rich and highly developed economies. The Republic of Macedonia also experienced such developments in the fiscal area and the public debt ratio doubled in the last decade. The aim of this paper is to investigate the fiscal sustainability of Macedonia using quarterly data for the period 2005 – 2016. We use a VAR model to determine whether the primary balance responds positively to increases in government indebtedness, thus ensuring fiscal sustainability, or is set exogenously and independently from changes in government liabilities. The empirical analysis shows that the primary balance lacks the necessary and sufficient positive response to an increase in the government debt level that helps prevent a further debt accumulation. These results, together with the drastically increased public debt since 2008, imply a need for a faster adjustment of the primary balance after a government debt shock in order to prevent reaching even higher debt levels and losing a valuable fiscal space.

Keywords: *fiscal reaction function, fiscal sustainability, primary balance, government debt, VAR*

1. INTRODUCTION

The recent global financial and economic crisis caused great concerns in many developed countries (especially in the EU) due to rising debt levels and deterioration of their fiscal space. In the face of the European debt crisis, public finance sustainability took center stage in economic discussions. These events have reconfirmed the adverse effects of the rising costs of an ever growing public debt on economic growth, monetary stability and public finance. This problem was not limited to rich and developed economies, but also appeared in countries in Central, Eastern and Southeastern Europe. The Republic of Macedonia also experienced bad developments in the fiscal area and the public debt ratio doubled in the last decade. The definition of the term fiscal sustainability is not straight forward. It is most often regarded as the long-term solvency of the government. A government is solvent if it is able, within an infinite horizon, to repay its debt with future primary surpluses without an explicit default (IMF, 2002), i.e. if the intertemporal budget constraint is met (Wyplosz, 2006; IMF, 2003). Fiscal unsustainability implies that current fiscal policies can not continue forever and sooner or later, an adjustment will be needed. Otherwise, the debt will explode. The capacity of maintaining high debt depends on the level of development of financial markets, the perceived risk, the trust

in the government capacity to implement reforms and consolidate deficits, the level of global risk aversion and investment alternatives to government securities. Some authors find that less developed countries have a lower debt tolerance and default can occur even at much lower debt levels (see Reinhart, Savastano and Rogoff, 2003; IMF, 2003). A common approach (see Canzoneri et al., 2001; Afonso, 2008; Afonso and Jalles, 2011, 2016), for the empirical investigation of fiscal sustainability is to assess whether the primary budget balance reacts positively to growth of public debt, meaning that the fiscal authorities are driven by stabilization and sustainability motives and whether the improvement of primary budget balance negatively influences government debt. Bohn (1998) introduced this approach, which shows that a sufficient condition for sustainability is that the government reacts systematically to increases in government debt by adjusting the primary balance (Bohn, 2005). This, according to Bohn (1995; 2007), is an error correction mechanism: if the public debt ratio grows, the government should respond by increasing the primary balance in order to keep or even reduce the debt ratio. Also this approach allows accounting for the influence of other heterogeneous, often transitory influences (Mendoza and Ostry, 2007). The aim of this paper is to investigate the fiscal sustainability of Macedonia using quarterly data for the period 2005 – 2016, by estimating a fiscal reaction function (following Bohn) within a VAR framework. In this light, the rest of the paper is structured as follows. Section 2 briefly reviews the empirical literature on the use of fiscal reaction functions in assessing fiscal sustainability, section 3 explains the implemented methodology, section 4 provides a discussion of the empirical results and section 5 gives concluding remarks.

2. OVERVIEW OF THE EMPIRICAL LITERATURE

There is a vast empirical literature on the issue of fiscal sustainability. The studies use various methods and different time horizons, as well as different choice of variables. Generally speaking, there are two classical methodological econometric approaches, focused on analyzing the time series characteristics of public debt and primary balance, or government revenues and expenditures, in order to check whether they are consistent with the necessary conditions for meeting the intertemporal budget constraint. Specifically, they test the stationarity of public debt or budget deficit, or the cointegration between public debt and primary surplus or between government revenues and expenditures (Wilcox, 1989; Hamilton and Flavin, 1986; Trehan and Walsh, 1991; Hakkio and Rush, 1991; Afonso, 2005;).¹ According to Bohn (2005), stationarity and cointegration tests can give misleading results, since they don't account for the uncertainty and are based on very strong assumptions, especially regarding the interest rate. The fiscal reaction function can be viewed as a backward-looking model based on historical data that indicates whether governments had the ability in the past to run higher surpluses, or at least to lower the primary deficit, when public debt increased. Here we focus on the studies that implemented a fiscal reaction function. Most studies focus on developed countries (Bohn, 2005; de Mello, 2008; Mendoza and Ostry, 2007; Afonso and Jalles, 2011, 2016; IMF, 2003; Baldi and Staehr, 2013; Wyplosz, 2006; Fincke and Greiner, 2012; Canzoneri et al., 2001). Some studies include both developed and developing or transition economies (IMF, 2003; Mendoza and Ostry, 2007; Ostry et al., 2010), while a growing body of literature focuses on CEE and SEE countries or other emerging and developing countries (Burger et al., 2011; Shijaku, 2012; Tanner and Ramos, 2002; Eller and Urvova, 2012; Zdravkovic et al., 2013; Llorca and Redgepagic, 2007; Zoli, 2005; Stoian and Campeanu, 2010; Trenovski and Tashevska, 2015). Most studies employ OLS single country analysis (Bohn, 2005; 2007; Burger et al., 2011; Shijaku, 2012; Tanner and Ramos, 2002; de Mello, 2008) and panel analysis (Mendoza and Ostry, 2007; Afonso and Jalles, 2011, 2016; IMF, 2003; Eller and Urvova, 2012; Baldi and

¹ These are so called backward-looking approaches, as opposed to forward-looking approaches, mostly based on the seminal work of Blanchard (1990), Blanchard et al. (1990), Buiter et al. (1993).

Staehr, 2013; Zdravkovic et al., 2013; Llorca and Redgepagic, 2007; Wyplosz, 2006; Fincke and Greiner, 2012), although a VAR approach has also been used (Canzoneri et al., 2001; Tanner and Ramos, 2002; Zoli, 2005; Burger et al., 2011; Shijaku, 2012; Trenovski and Tashevskaja, 2015; Afonso and Jalles, 2011, 2016). Bohn (1998) found strong evidence in favour of the sustainability of the US fiscal policy in the 20th century and concludes that policy-makers eventually reacted to the accumulation of large debt positions over this period of time. Bohn (2005) confirmed these findings. First he examined the stationarity of public debt and deficit series and found no unit roots, and then revealed a positive response of primary balance to public debt in the US (1792–2003). Wyplosz (2006), Fincke and Greiner (2012) and others focus on European countries and find some evidence of a positive feedback from debt to the primary balance. De Mello (2008) finds that in Brazil the primary balance reacts positively and strongly to the lagged debt stock. Mendoza and Ostry (2007) looked at data for 34 emerging and 22 industrialized countries and confirmed that the sustainability condition was met in the countries with moderate debt levels, but not in the highly indebted countries. They warn against a smaller ability of governments to keep fiscal solvency above a 50-60% of GDP level. They found a stronger response in the emerging countries because a riskier fiscal and financial environment requires a stronger response to maintain the fiscal sustainability. IMF (2003), on the other hand, found that the primary balance response weakens with the growth of the debt ratio in the emerging economies and stops at a 50% of GDP level, while in the industrialized countries, there is a strong reaction at high debt levels. Afonso and Jalles (2011) investigated the relationship between primary balance and debt for OECD countries for the period 1970-2010 using panel VAR and found evidence that fiscal authorities do seem to care about the sustainability of public finances. Berti et al. (2016) estimated a fiscal reaction functions for EU countries and their results indicated that authorities mainly positively adjust their fiscal policy to rising levels of public debt, although to a weak extent in some cases. Eller and Urvova (2012) found a positive response of primary balance to debt shocks in eight CESEE countries, confirmed in Zdravkovic et al. (2013) for a panel of 21 CESEE countries. Stoian and Campeanu (2010) got mixed results for the reaction of primary balance to debt for a group of CEE countries.

3. METHODOLOGY

The analysis is based on a fiscal reaction function, following Bohn (1995; 2007). These analyses usually assess the primary balance reaction to changes in public debt, which is included in the model with one lag. The systematic, that is, average response of the primary balance to past debt is crucial for the fiscal sustainability. If the fiscal authorities react systematically to indebtedness by improving the primary balance in order to maintain public debt sustainable throughout time, then the transversality condition is met and the fiscal policy prevents excess debt accumulation (Bohn, 1998). The public debt evolution depends on whether the concern for debt sustainability dominates the snowball effect or vice versa. Its main advantage lies in the direct testing of the link between primary surplus and public debt, which does not require any explicit strong assumptions about the interest rates. However, as Ghosh et al. (2013) point out that this condition can be thought of as weak sustainability that does not, for example, rule out a permanently increasing debt-to-GDP ratio. The use of primary balance, instead of total budget balance has an advantage because the government controls primary expenditures more easily, while the interest payments are an exogenous category and are determined by past activities of fiscal policy related with borrowing (Angelovska-Bezovska et al., 2011). As in other studies (Bohn, 2007; Ostry et al., 2010; Eller and Urvova, 2011; Afonso and Jalles, 2011) we use cyclically unadjusted balance, because: this helps avoid the difficulties of the methodology for calculating cyclically adjusted variables related to potential GDP; the cyclically adjusted primary balance can be influenced by temporary factors, not directly related

to the cycle, such as onetime operations, creative accounting and classification errors. It should be taken into account that primary balance includes the response of automatic stabilizers, as well as of discretionary policy. The usual way of assessing the fiscal reaction is by estimating a regression equation where the primary balance is the dependent variable. The basic formula is the following:

$$pb_t = \beta_0 + \beta_1 d_{t-1} + \beta_2 z_t + \varepsilon_t \quad (1)$$

where pb_t is the primary balance, d_{t-1} is the lagged debt, z_t is a vector of control variables and ε_t is the error term. Usually the models contain the output gap as a control variable, which reflects the business cycle and shows whether the government conducts a short term aggregate demand stabilization policy (Bohn, 1998; Burger et al., 2011; Budina and van Wijnbergen, 2008; Mendoza and Ostry, 2008; Celasun, Debrun and Ostry, 2006; Afonso and Jalles, 2011; Fincke, 2013; Eller and Urvova, 2012). A positive response of the primary balance to the output gap shows that during favourable economic conditions the budget position of the government improves, indicating a countercyclical fiscal reaction. Most of the estimated fiscal reaction function for developing countries are based on panel regression models since there are no long data series for individual countries (Celasun, Debrun and Ostry, 2010; Mendoza and Ostry, 2008; Eller and Urvova, 2012 etc.). However, as Budina and van Wijnbergen (2007) point out, assessing fiscal reaction with panel data cannot capture well the specific situation in a certain country despite the inclusion of fixed country effect. Therefore in this paper we assess the fiscal reaction only for Macedonia. The use of VAR model that captures multiple interactions between the endogenous variables in the models gains importance (Tanner and Ramos, 2002; Afonso and Jalles, 2011; Burger et al., 2011; Shijaku, 2012). The endogenous variables are explained by their own past values and the past values of the other variables (see Stock and Watson, 2001). When assessing regression equations with OLS, if the model contains non-stationary series, it could provide spurious results. Hence, following Burger et al. (2011) and Afonso and Jalles (2011), we use a vector model. We give preference to the vector model also due to the fact that the OLS method omits the feedback effect of primary balance on debt. Namely, this framework does not distinguish between ex-post primary balance adjustments to government obligations (public debt) and ex-ante adjustments of government obligations (public debt) to primary balance (Tanner and Ramos, 2002, Canzoneri, Cumby and Diba, 2011).

We use a two-variable VAR model with debt and primary balance, in order to assess the fiscal reaction to debt (see Tanner and Ramos, 2002; Burger et al., 2011; Shijaku, 2012; Afonso and Jalles, 2011; Zoli, 2005; Trenovski and Tashevska, 2015). This type of model is commonly used to determine the dominant regime of economic policy – fiscal or monetary (Canzoneri et al., 2001; Fialho and Portugal, 2005; Zoli, 2005). Here we follow the approach of Tanner and Ramos (2002), who analyze the fiscal sustainability of Brazil and Zoli (2005), who analyzes fiscal and monetary policy in the developing countries. The model captures the relationship between the present public debt level and the future primary balance and between the present primary balance and the future public debt level and can be presented as follows:

$$X_t = \beta_0 \sum_{i=1}^p \beta_i X_{t-i} + v_t \quad (2)$$

where $X_t = [\text{primary balance, public debt}]$, β_i is a vector of coefficients v_t is an error terms vector. Each element in the vector of error terms consists of own errors w_t and contemporaneous correlations with other errors: $v_t = Bw_t$. where B is a matrix of diagonal elements equal to one, and the elements out of the diagonal that are different than zero reflect the contemporaneous

correlations between the residuals. The VAR model estimates the causality of the time series in both directions (Zoli, 2005)²:

$$pb_t = \alpha_0 + \sum_{j=1} \alpha_j pb_{t-j} + \sum_{j=1} \beta_j d_{t-j} + \varepsilon_t \quad (3)$$

$$d_t = \gamma_0 + \sum_{j=1} \delta_j pb_{t-j} + \sum_{j=1} \gamma_j d_{t-j} + \mu_t \quad (4)$$

Where pb_t denotes primary government balance, while d_t is general government debt. First we assess a model where pb comes first and d second. The order of variables follows the logic that primary balance has a direct and contemporaneous impact on debt, as one of its components, whereas the debt level has a lagged impact on primary balance. This is in accordance with Bohn's fiscal reaction function where in the regression model the public debt is included with a lag. In the second variant of the model d is the first variable, in order to see if the previously gained results will change (see Tanner and Ramos, 2002). When interpreting the results, it has to be taken into account that the model does not include a variable that reflects the cyclical movements of the economy. In case of short series (like ours), a lack of a significant relationship between the primary balance and the public debt can be found, but that could arise also from the unpreparedness or inability of the government to create larger primary balances in period of recessions (Zoli, 2005). Thus, to complement the analysis, we expand the VAR model with the output gap (Afonso and Jalles, 2011; Burger et al., 2011; Shijaku, 2012) and a control dummy variable *crisis*.

3.1. Data and variables

The analysis is based on quarterly data for the period 2005Q1 – 2016Q4. A key fiscal policy measure is the general government primary balance (PB), calculated as a difference between government revenues and primary government expenditures. A measure of the indebtedness is the general government debt (D). Both variables are expressed as ratio to GDP. The data series are presented in figure 1. Until 2008 there is a drastic fall in debt, accompanied by more favourable primary balances. Since the end of 2008, marked with a significantly increased deficit, there is a period of constant debt growth, but the primary balance does not show signs of systematic reaction in the direction of slowing the debt growth. Hence we do not expect to find a statistically significant reaction of the primary balance to debt shocks.

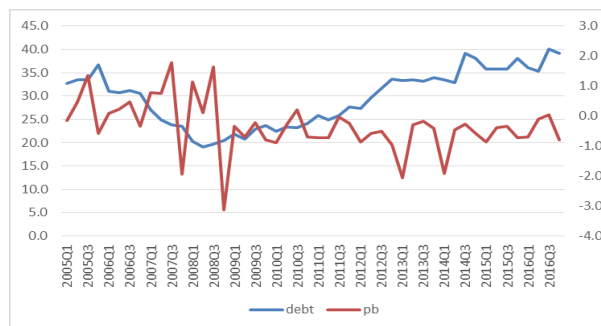


Figure 1: Primary balance and government debt (authors' calculations)

The output gap (YGAP) is calculated as a percentage deviation of the current real GDP level from its long run trend, while the long run trend is calculated with the Hodrick-Prescott filter. For robustness check, the output gap is replaced in the model with the real GDP growth (G).

²Zoli (2005) uses first difference of the variables due to public debt non-stationarity. However, we estimate the model in levels, considering the dilemma on the necessity for stationary series in VAR (see Lutkepohl, 2011).

The impact of the crisis is captured with a dummy variable crisis, with value 0 up to the third quarter of 2008 and 1 after that, to account for the shift in the trend of government debt and in the behaviour of the fiscal authorities. The series were seasonally adjusted, in order to prevent a possible distortion of the results due to seasonal components, which are especially frequent in government expenditures series (used to calculate the primary balance). The unit root tests provide mixed results for stationarity of the primary balance. The ADF test finds it stationary at 10% confidence level, the PP test finds it to be stationary and the KPSS test rejects the null for stationarity at 10% and 5%, but not for 1%. Concerning the general government debt, we can conclude that it is I(1). The output gap and real GDP growth rate are stationary.³ While the OLS model can give distorted results when the model includes nonstationary series, there is a wide debate over the necessity of stationarity of all series in a VAR model (Lutkepohl, 2011; Burger et al., 2011). Hence the nonstationarity is not expected to be an obstacle for reaching good quality results. The data comes from several sources. The government revenues and expenditures, including interest expenditures data (used to calculate the primary balance) come from the bulletins of the Ministry of Finance of the Republic of Macedonia and from the bulletins and quarterly reports of NBRM. The nominal GDP data are taken from the statistical base of the State Statistical Office, while the real GDP and GDP growth rate data are taken from the bulletin of the NBRM for the fourth quarter of 2014. The general government debt data are taken from the database on the website of the Ministry of Finance.

4. DISCUSSION OF RESULTS

The VAR model⁴ is bivariate, consisting of data series on primary balance and general government debt. The number of lags was determined using the information criteria, which suggested using two lags. The results are shown in table 1.

Table 1: VAR Lag Order Selection Criteria (authors' calculations)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-176.6093	NA	16.93646	8.505205	8.587951	8.535535
1	-112.9439	118.2357	0.988793	5.663996	5.912235*	5.754985
2	-106.2582	11.77958*	0.871639*	5.536105*	5.949836	5.687754*
3	-104.3227	3.225930	0.965543	5.634412	6.213635	5.846720
4	-101.2188	4.877519	1.014934	5.677085	6.421800	5.950052
5	-96.73456	6.619565	1.003268	5.654026	6.564234	5.987654

* indicates lag order selected by the criterion

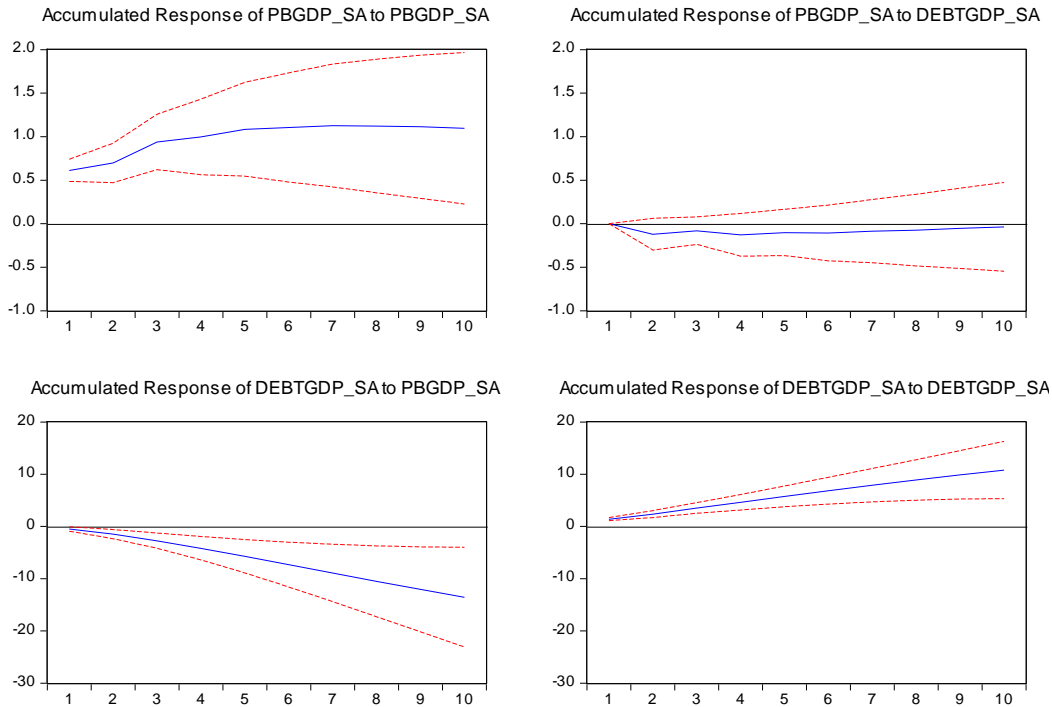
First we estimated a model where the order of the variables is primary balance, debt. The model is stable – all inverse roots of the characteristic polynomial are inside the unit root circle. The necessary assumptions about no serial correlation (Portmanteu test and LM test for serial correlation) and homoscedasticity (White homoscedasticity test) are also satisfied. The accumulated impulse response functions show a statistically insignificant response of the primary balance to debt shocks (mostly negative) and a negative response, i.e. reduction of debt following a primary balance shock, significant during the whole analyzed period. Canzoneri, Cumby and Diba (2011) explain the fall in debt in the following way: the primary surplus is used to pay part of the current debt and hence the future year debt is smaller.

³ The test results are not presented here due to limited space, but are available upon request. The same applies for all following results that are not presented in the paper.

⁴ Before moving to estimating the VAR, a Johansen cointegration test was performed, since for analyzing the interdependence of cointegrated series a VECM is necessary. However, no cointegration was found.

A primary balance shock causes a positive self-reaction, indicating an inertia in conducting the fiscal policy (however the significance fades away), leading to a further debt reduction. On the other hand, the automatic debt dynamics is significant throughout the whole period.

Figure 2: Accumulated impulse response functions (authors' calculations)
 Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.



Angelovska-Bezovska et al. (2011) find a positive primary balance response to a debt shock using the GMM method. However, it should be considered that their analysis includes a very short time series of annual data (1990-2009) and it captures the pre-crisis period, i.e. before the Macedonian economy felt the consequences of the global economic crisis. On the other hand, Trenovski and Tashevska (2015), using a VAR model, find no statistically significant primary balance response. The variance decomposition shows that there is a very small percent of the variance of error prediction of the primary balance that is explained by debt shocks (0% in the first quarter, 4% in the fourth quarter and 4,4% in the tenth quarter) and the share of primary balance shock in explaining variance of the prediction error of debt is larger, growing from 11,6% in the first period to 62,3% in the tenth period. This result is confirmed with the Granger causality test (table 2). The result shows that past values of debt do not help to explain the short run movement of primary balance, while primary balance Granger causes debt.

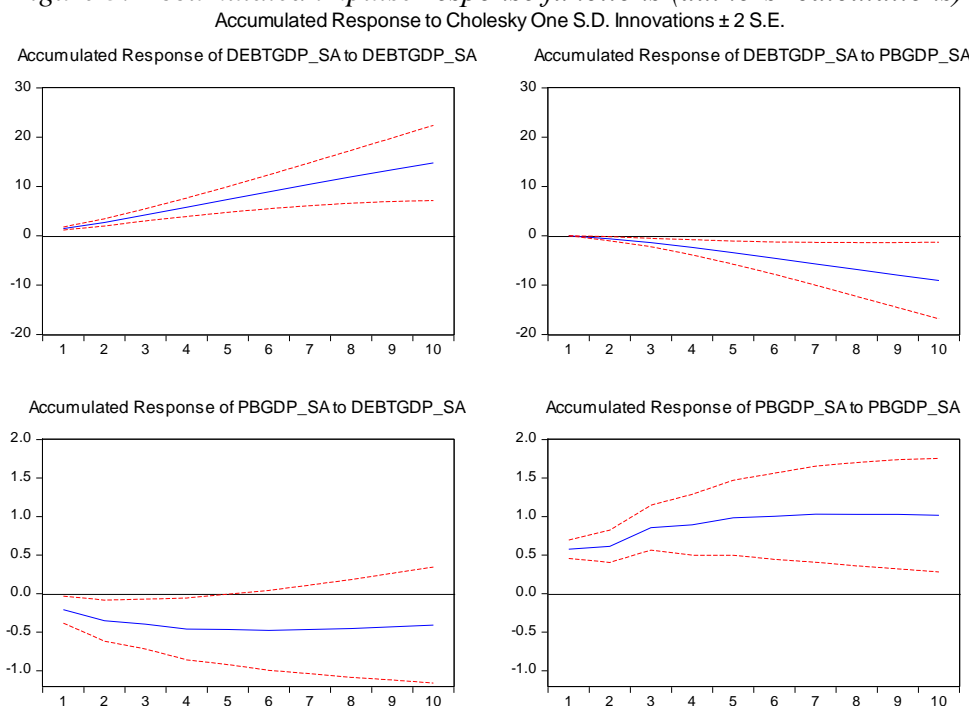
Table 2: VAR Granger Causality/Block Exogeneity Wald Tests (authors' calculations)

	Chi-sq	df	Prob.
D does not Granger cause PB	2.260279	2	0.3230
D does not Granger cause PB	12.12236	2	0.0023

For a robustness check, a VAR model with an inverse variable ordering (D, PB) was assessed. The model is stable and satisfies all necessary assumptions. The accumulated impulse response functions show that after a debt shock, the primary balance decreases (the reponse is only statistically significant until the fifth quarter). This result implies a behaviour that does not lead to debt sustainability in the long run.

On the other hand, the debt decreases after a primary balance shock, and the response is statistically significant. The debt and primary balance inertia is confirmed.

Figure 3: Accumulated impulse response functions (authors' calculations)



Later we expanded the model with an additional variable - the output gap and with the exogenous control variable - crisis. However, this did not cause remarkable changes in the primary balance response to debt shocks and vice versa. With the inclusion of the output gap, the accumulated impulse response functions show that the primary balance response remains negative or neutral and insignificant. The output gap has no significant impact on the primary balance. However, if we replace the output gap with the real GDP growth rate, then the impulse response functions show a positive reaction of the primary balance to GDP shocks. Hence, a strong economic growth is key to improving the fiscal situation. When the model is expanded with the variable crisis, there is no statistically significant reaction of the primary balance nor of the public debt. The explaining power of the variables shocks for the variance of prediction error is also reduced, implying that the crisis effect dominates other influences. Overall, the model shows that the primary balance does not react systematically to increases in public debt in direction of preventing its further accumulation. Thus it does not meet the Bohn criteria for fiscal sustainability. The improvement of the primary balance causes, as expected, a reduction of the indebtedness of the country. The presence of the same reaction in all specifications of the model confirms the robustness of the relationship.

5. CONCLUSION

The results of the empirical analysis show that the primary balance lacks the necessary and sufficient positive response to an increase in the government debt level that helps prevent a further debt accumulation. The primary balance response to debt shocks remains negative or neutral and insignificant in the model using the output gap. The output gap has no significant impact on the primary balance. However, in the model with the real GDP growth rate, the results indicate a positive reaction of the primary balance to GDP shocks. Hence, a strong economic growth is key to improving the fiscal situation.

These results, together with the drastically increased public debt since 2008, imply a need for fiscal tightening and measures to boost economic growth, since they signal a lack of sufficient fiscal stabilization efforts. The fiscal authorities need to be more responsive to a government debt shock in order to act countercyclically and to prevent reaching higher debt levels and losing valuable fiscal space. The level of debt in Macedonia is not extremely high (39,6% - general government debt; 48,5% - public debt), but the growth dynamics in the last decade are worrisome. International organizations (World Bank, IMF) have warned against the further increase in debt and suggest conducting fiscal consolidation.

According to the IMF, while the growth of real GDP is the key category that reduces the Macedonian government debt, the primary deficit contributes the most to its growth. This means that it is necessary to enforce measures for reduction of the primary deficit in order to stabilize the debt.

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