Does the fiscal policy have an impact on economic growth through the fiscal multiplier in Algeria?

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Abstract

The aim of this paper is to analyze the effects of discretionary measures of fiscal policy on the economic activity and to estimate the size of fiscal multiplier s in Algeria. Econometric framework is based on the structural VAR model SVAR),with Blanchard-Perotti identification method that uses information on institutional characteristics of fiscal system. onsolidated and general consolidated government and aggregate demand for the period from 2004-2021.The results show that our initial assumptions about the difference in the size of the multiplier of government expenditures and indirect tax revenues between three levels of government consolidation have been confirmed.

1. *Introduction*

Recent economic crisis has stimulated new research about the effects and possibilities of the stabilization function

of fiscal policy. The results of stabilization activities of the fiscal policy depend on the taken discretionary measures. Since the discretionary measures are in the political decision making domain, timely activities of the fiscal policy, regardless of the possible economic restrictions, often come down to the domain of "alchemy" (Leeper, 2010). However, despite the theoretical framework and restrictions inside which the fiscal policy is observed, it has kept a significant status in the economic policy in the conditions of crisis. The relevance of the effectiveness of fiscal policy measures is even greater in small, open economies with managed exchange rate like Algeria, where monetary policy can not be active. The subject of this paper is to analyze discretionary fiscal policy measures in Algeria, whose possibilities and effectiveness are most often observed within the theory of the fiscal multipliers, both on theoretical and empirical level. The size of the multiplier is defined by different structural characteristics of the economy. The main goal of this paper is to estimate the size of the multiplier of government spending and (indirect) taxes in Algeria. According to the existing literature, it is the first attempt of this kind. Considering the fiscal centralization of Algeria, estimation of fiscal multipliers and fiscal policy activities will be conducted on all three government levels (the central, central consolidated and general consolidated government level).the main hypothesis of the paper is that there is a difference in the multiplier size among three levels of government, especially the one related to government spending, that is assumed to be the highest at the general government level. Because of high fiscal decentralization, Algeria realizes most of her tax revenues

the assumptions about the characteristics of open economies, but on a larger sample of countries in order to avoid problems associated with the length of the time series in Algeria. For the purpose of testing before mentioning hypothesis and achieving mentioned

goals, the paper is structured as follows. The literature review is given in the second section of the paper, after the introduction. The emphasis is on the literature that uses vector auto regression methodology (VAR) while calculating fiscal multipliers and fiscal policy effects. Afterwards, the third section will briefl y describe the applied econometric method. The method used is for identificationof structural VAR (SVAR) model is based on the proposed identifications cheme by Blanchard Perotti (2002). The next section analyses used data. Section Five presents the effect fiscal shocks on the private consumption and private sector demand. Moreover, it presents the calculated

results of the government spending and tax multiplier. Final section concludes and states the restrictions in the applied methodology.

2. *Literature review:*

When the stabilization fiscal policy in Algeria is analyzed, it is hard to find a unanimous answer. The reason for this situation lies in a few facts. Firstly, there are a rather small number of empirical research in Algeria. The existing research differs by the methodology and results, thus the basis for any kind of fiscal policy assessment in Algeria is hard to fi nd. Also, it is of great importance that fiscal policy measures have some empirical background in form of policy simulations

and the main precondition for quality simulations is information about the size, characteristics and dynamics of fiscal multipliers. Fiscal multipliers are defined as multiplier of government spending and indirect tax multiplier. From the theoretical point of view, government spending multiplier should have stronger effect on national output or aggregate demand, even in case of balanced budget (Haavelmo, 1945). In this context, stabilization measures of fiscal policy should be more

focused on the management of public expenditures rather than tax measures and regular changes of tax legislative .Generally, empirical work on fiscal policy can be structured in several directions.

2. First, in VAR literature four main identification approaches have been used: narrative approach (Ramey & Shapiro, 1999) calibrated elasticities (Blanchard & Perotti, 2002) sign restrictions (Mountford & Uhlig, 2002 & 2009), recursive structure (Kamps & Caldara, 2006). Second, analyses of empirical results include dynamic responses to different fiscal shocks and/or fiscal (tax and spending) multipliers, and frequently interpretation of historical facts. Third and last, VAR as standard methodology has developed into more advanced models which simulate fiscal shocks like DSGE (dynamic stochastic general equilibrium) models. DSGE literature is growing as are different DSGE models like real business cycle (RBC) models and New Keynesian (NK) models. For DSGE literature review and methodology development see Leeper at al. (2012). The pioneers of the empirical research on the effects of fiscal policy in the framework of VAR methodology are Ramey and Shapiro (1999) including Edelberg et al. (1999). They have based their researches on the fiscal dummy variables associated with periods characterized by exogenous changes in the fiscal policy. This form of identification of VAR model was later called the narrative approach, and today narrative approach is still developing and is used in contemporary research (Romer & Romer, 2010) the first paper in which SVAR model is used for the assessment of the effects of fiscal policy is Blanchard & Perotti (2002). Today, Blanchard-Perotti (2002) is a certain benchmark in the analyses of the effects

of fiscal policy that uses SVAR methodology, which is also the case in this paper. In the identification of SVAR model Blanchard-Perotti (2002) use the information about the institutional elements of fiscal system, in that way setting restrictions on the automatic reactions of government revenues and expenditures to the economic activity. The analysis is conducted on quarterly data of the real net tax revenues, government spending and GDP of the United States from 1947 till 1997. Later Perotti (2005) extended the model by adding short-term interest rate and price levels. The author concludes that the positive shocks in the government spending have a positive effect on the economic activity, whereas positive tax shocks cause a negative effect. The estimated size of the multiplier is smaller than 1. In addition, the authors conclude that the consumption shocks and the increase of taxes have a negative impact on the private investment. Regarding the relevant international literature, for good review of the literature and last theoretical and empirical results within the fiscal policy, see Sever et al. (2011), and for the trends and the international overview of the answers given to the crisis by the fiscal policy, see OECD (2009) and IMF (2008, 2009, 2010, 2011). The assessments of the size of fiscal multipliers, based on different methods and made for different countries, as well as a detailed review of the literature related to the assessments of the effects of fiscal policy are possible to find in Spilimbergo et al. (2009), Ramey (2011), while the detailed methodology using SVAR, that is SVEC model, is possible to review in Ilzetzki et al. (2011) and Caldara & Kamps (2012). The additional review of the papers which in the assessments of the effects of fiscal policy use (S)VAR methodology can be found in Hur (2007), Mirdala (2009), Baxa (2010), Mancelarri (2011) and Ravnik & Žilić (2011). Furthermore, the literature review is firstly aimed at the domestic literature, especially the literature focused on the fiscal multipliers and that uses VAR methodology which is the primary methodology within this research. There are a few papers in Algeria that use VAR methodology in the estimation of the effects of fiscal policy. Since different aspects of fiscal policy are used in the papers, in Table As it can be seen in Table 1, in the domestic literature it is possible to fi nd only one paper Ravnik & Žilić (2011) that uses SVAR in the estimation of the effects of fiscal policy by applying Blanchard-Perotti (2002) method of identify cation. When it comes to the papers that estimate the fiscal multipliers in Algeria, not a single one has been found in the existing literature. According to the fact that the subject of this paper is the impact of fiscal policy, it is necessary to mention a certain number of papers that analyze the connection between fiscal policy and economic activity, but do not use the VAR methodology. Sever (2005) analyses the effect of external debt to economic growth in Algeria by applying the regression analysis.

3. *Model specification and Blanchard-Perotti identification:*

discretionary measures of the fiscal policy have always been and will remain a matter of discussion Nevertheless, scientifically defined facts and internationally recognized trends should be a certain basis in the formation of the stabilization fiscal policy in Algeria. By analyzing the international literature one can easily conclude that VAR, that is, structural VAR (SVAR) model, has become a certain standard in the research of evaluation of the fiscal policy effects. The same conclusion applies when talking about the fiscal multipliers. For the estimation of size and duration of the effects of fiscal multiplier SVAR or structural VEC (SVEC) model is most often used, while utilizing different explanatory (government spending, government investments, public transfers, direct and indirect taxes) and variables of interest (personal spending, investments, interest rate, industrial production, GDP). Unlike Blanchard-Perotti (2002), who conduct the analysis for USA and Perotti (2002) who analyses the larger OECD countries (Germany, Great Britain, Australia, Canada), there is a large variety of papers that use the mentioned methodology in the research of the effects of fiscal policy in transition countries.3 Taking into account the particularities of Algerian economy, the model in this research is tested at the general government and central government level. Because of the high fiscal decentralization, Algeria realizes most of her tax revenues through the central government budget. As most of the budgetary central government budget expenses are spent for covering the current expenditures (pensions, health, wages in the public sector etc.), a larger amount of the capital expenditure is visible only through the consolidated central government level (mostly through public enterprises) and general government level (capital expenditures are mostly realized through the local budgets). These mentioned facts should have an influence on the size of the multiplier. The first step in the analysis is the estimation of the reduced-form VAR model

$$X_t = \Psi + \Phi D_t + \Gamma T_t + \sum_{i=1}^{p} A_i X_{t-i} + u_t$$

that icludes defl ated, seasonally adjusted log values of indirect tax revenues (T_t), total expenditures of central/general government (G_t) and aggregate demand ofthe private sector (AD_t). Therefore, X_t = [T_t, G_t, AD_t] is a vector of the variables of interest. The deterministic variables included in the model are constant (Ψ), time trend (T_t) and qualitative "crisis" dummy variable (D_t), which is assumed to be 1 from the beginning of the crisis (Q42008)4 onwards. The vector u_t = [t, g, ad]´ is a reduced form innovation vector (RF), $u_t \sim (0, \Sigma u)$. The number of time lags is found to be 1, according to SIC and HQ criteria. Also, larger number of lags is not preferable because of the small

time series. Moreover, regarding the data frequency, the choice of one time lag also has a basis in the economic intuition. The information on RF innovations is given based on the estimated reduced-form model (1.1).The RF innovations are mutually correlated and represent a linear combination of structural innovations, which disables their precise economic interpretation (Bahovec & Erjavec, 2009). The linear combination of structural innovations (shocks) according to Blanchard-Perotti (2002) can be shown as

$$t_t = a_1 ad + \beta_2 e_t^G + \beta_1 e_t^T$$

$$g_t = b_1 ad_t + \beta_4 e_t^T + \beta_3 e_t^G$$

$$ad_t = c_1 t_t + c_2 g_t + \beta_5 e_t^{AD}$$

where et t, eg t , et AD represent the structural shocks of tax, government expenditures and aggregate demand. The equations (1.2)-(1.4) can be written

$$\begin{pmatrix} 1 & 0 & a_1 \\ 0 & 1 & b_1 \\ c_1 & c_2 & 1 \end{pmatrix} \begin{pmatrix} t_t \\ g_t \\ ad_t \end{pmatrix} = \begin{pmatrix} \beta_1 & \beta_2 & 0 \\ \beta_4 & \beta_3 & 0 \\ 0 & 0 & \beta_5 \end{pmatrix} \begin{pmatrix} e_t^T \\ e_t^G \\ e_t^{AD} \end{pmatrix}$$

which gives a form Aut = Be t of SVAR model. In order for this system to be identified, it is necessary to set $2K^2 - K - 1 - 2K(K + 1)$ restrictions that preferably have a basis in the economic theory. Since the number of endogenous variables

is K=3, after the diagonal elements of matrix A are normalized, 9 additional restrictions need to be set. The baseline assumptions of the model (shown in the equations (1.2.)-(1.4.), implicate 6 of them. Therefore, 3 more restrictions need to be imposed. In the process of identification, quarterly data frequencies are the most important. The reason for that is the assumption that the policy makers cannot react on the changes in the economic environment within one quarter. There are numerous

information, administrative and procedural obstacles to the reaction of the economic policy in such a short period; the procedural obstacles within the parliament etc.

So, the reaction of the fiscal variables to the changes in the economic activity can only be automatic, i.e. the reaction can only be an outcome in the activity of the automatic stabilizers. The mentioned fact enables the setting of restrictions in the model. The restrictions are based on the empirical estimation of the exogenous elasticities of the fiscal variables in comparison with the changes in the certain macroeconomic aggregates Specifically, a1 and b1 parameters can be interpreted as

(automatic) elasticities of the tax revenues and expenditures to the changes in the aggregate demand. The total calculated elasticity of indirect taxes to private AD equals to $a1 = 1.055$. next, according to Blanchard-Perotti (2002), Ravnik and Žilić (2011), Hur (2007), Ravn and Spange (2012), all coefficients related to the equation of the reduced innovation of government spending should equal zero. The reason for that is found in the assumption that the government spending is completely under the control of the economic policy makers that cannot react to changes in the economy instantaneously, i.e. in the first quarter after the "shock". However, Cladara (2011) warns about the "automatic" reaction of the government spending components (which are related to unemployment) to the business cycle. Taking into account this correlation it is necessary to calculate the exogenous elasticities of those components to the changes in the business cycle. Yet, according to the Grdović Gnip (2011) estimation, that elasticity in Algeria is very small (-0.01). Therefore in this paper it is also assumed that the total expenditures cannot have an influence on the changes in the aggregate demand within the same quarter, hence $b1 = 0$. In order to achieve a correctly identified system, it is essential to set one more restriction. The parameters $\beta2$ and $\beta4$ describe how the taxes react to the changes in the government spending, i.e. how government spending reacts to the changes in taxes. For the system to be identified it is necessary to assume that one of this parameters equals to 0, i.e. that only one variable effects the other. In this paper it is assumed that the tax revenues can react to the changes in the government spending,

therefore $\beta4 = 0$. Regarding the mentioned restrictions, the final form of the SVAR model, is as follows:

$$\begin{pmatrix} 1 & 0 & -1.05 \\ 0 & 1 & 0 \\ c_1 & c_2 & 1 \end{pmatrix} \begin{pmatrix} t_t \\ g_t \\ ad_t \end{pmatrix} = \begin{pmatrix} \beta_1 & \beta_2 & 0 \\ 0 & \beta_3 & 0 \\ 0 & 0 & \beta_5 \end{pmatrix} \begin{pmatrix} e_t^T \\ e_t^G \\ e_t^{AD} \end{pmatrix}$$

For this model with different endogenous variables, adequacy and stability analysis was conducted. The results of the residual analysis (test of autocorrelation, normality test and heteroskedasticity test) and the stability test indicate that the model is appropriate and stable. After the estimation of the structural form of the model, the tests have been repeated (including the test for normality in residuals from the structural model). The repetition did not change the conclusions about the adequacy of the models..

Data:

The source for the data on indirect tax revenues and total expenditures (including non-financial assets transactions/public investment) is the Ministry of Finance. The time series of the consolidated central

and general government on the web pages of the Ministry of Finance start from the year 2004 (after the change of the GFS methodology). Data of the components of the aggregate demand are taken from national accounts series, . empirical analysis, stability and adequacy tests and seasonal adjustment were performed using statistical software Eviews10.

Figure 1: Government expenditures, indirect taxes and private AD in Algeria 2004-2021

Figure 1 shows movements of data that is used in our three models. It is important to notice several characteristics that could influence the results of our model: (i) there are structural breaks in all series at the end of year 2008, i.e. the beginning of recession in Algeria; (ii) there are numerous unexplainable outliers (spikes) in series of
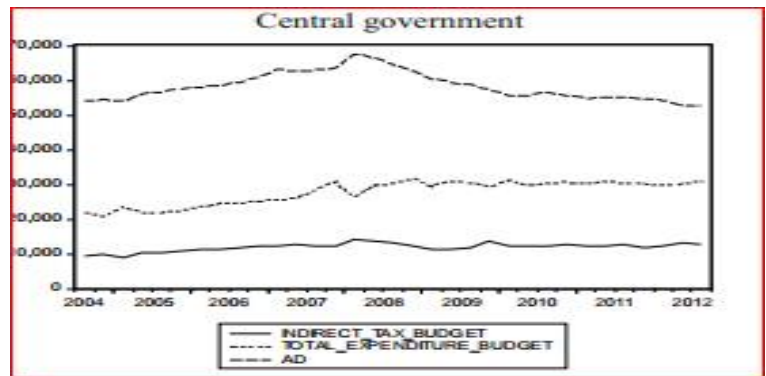
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indirect taxes and government expenditures, (iii) Algerian economy has been faced with recession conditions for 48%; (iv) although one could conclude

that some series are non-stationary, Zivot-Andrews unit root test6 showed that all variables are stationary, at usual statistical significance levels, which is not surprising due to quite short time series dynamics of government expenditure and indirect tax revenues have very similar dynamics on all three levels of consolidation, while the difference in the values are mainly the result of net acquisition of non-financial assets. Domestic aggregate demand of private sector is calculated as the sum of private consumption and gross fixed investment, as in Giordano et al. (2005). This indicator is providing the information on the impact of fiscal variables on the sector of the households and enterprises. Also it eliminates the possible correlation between fiscal shocks and GDP components related to public spending. Furthermore, the total GDP includes components such as inventories and the level of imports which the domestic fiscal shocks cannot directly affect. They are changing as a result of changes in personal consumption (or AD). Also, the mechanism of the instantaneous impact of fiscal spending shocks and indirect taxes on exports is not known in the economic literature. Also, domestic private AD (excluding imports and exports) is the logical choice for the analysis based on a closed-economy theoretical and empirical framework. The indirect taxes are used in the analysis for three reasons: (i) as mentioned in the introduction, the aim of this paper is to analyze the effects of fiscal policy on aggregate demand. According to the theory, income tax and corporate tax are mostly affecting aggregate supply by influencing the behavior of workers and enterprises

(Jurković, 2002: 260-263); (ii) SVAR models are much more suitable for the analysis of shocks to aggregate demand side (Ravn & Spange, 2012; Blanchard & Perotti, 2002). Because of the complexity of the mechanism of the impact of taxes on aggregate supply, their effects need to be evaluated in the

broader methodological framework of DSGE models, (iii) household decisions on current spending can change in a relatively short time (within a quarter or two, except in the case of necessity products).

. *Results and discussion:*

In this section the results of impulse-response analysis are presented. Impulses were adjusted to present the size of fiscal multipliers as in Mountford and Uhlig (2002) and Hur (2007), can be provided on request. Fiscal shocks in IRF analysis represent an increase of "independent variable" by one standard deviation, so the elasticity of aggregate demand to each fiscal shock is defined as the ratio of the change of log AD (percentage increase) and the standard deviation of the sample of corresponding fiscal shock (rate of change). If the mentioned ratio is multiplied by the reciprocal value of the average share of each fiscal variable in aggregate demand then one can obtain the value of multiplier, according to the formula for elasticity (see Hur (2007); for mathematical derivation see Caldara (2011)).

Table 2: Fiscal multipliers in Algeria 2004q3-2017q3

As it can be seen in Table 2 our results confirm the main hypothesis of the paper about the difference in the size of fiscal multipliers between three levels of government consolidation

. As in standard literature, cumulative multipliers after four

Fiscal multipliers	Central government budget	Consolidated central government	Consolidated general government
Tax			
4 quarters	-0.636	-2.15	-1.32
8 quarters	2.61	-0.66	-0.81
Government expenditure			
4 quarters	0.82**	1.58**	2.18**
8 quarters	1.60	1.80**	1.91**
Tax			
High	-1.06 (q1)**	-1.11 (q1)	-0.82 (q2)
Low	-0.68 (q2)	-0.06 (q16)	-0.08 (q16)
Government ependiture			
High	0.98 (q2)**	1.20 (q2)**	1.39 (q2)**
Low	0.17 (q16)	0.19 (q16)	0.19 (q16)
Reversed sign			
Tax	q3-q16	-	-
Government expenditure	q1***	q1	-

Note: *within 95% confidence interval; **within 68% confidence interval

Eviews 10 results

and eight quarters following the (discretionary) unexpected shock in each fiscal variable are presented. The value of government spending multiplier (impact and cumulative) is largest at the consolidated general government level and smallest on the

central budget level. Also, the impact of fiscal policy shocks on consolidated central and general government is statistically significant in longer period. It is important to notice that our results suggest some (theoretically) unexpected and statistically signifi cant effects of government spending at the central government budget level, where the increase of government expenditure reduces private aggregate demand in the first quarter (the impact is positive form second quarter onwards). Negative effects of government spending are most commonly interpreted through Ricardian equivalence and public spending ineffectiveness hypothesis, but since this result is short-lived, one can conclude that these explanations are not plausible for our analysis. On the other hand, tax multiplier is the largest on consolidated central government level, which is expected since most of the tax revenues in Algeria is collected at this level. But, confidence intervals show that the impact is not statistically significant. Only statistically significant result for tax effects shows that an increase in taxes for one unit (from the mean) reduces private aggregate demand in the first quarter by 1.06 units. Statistical insignificance of results could be explained by large standard errors in series of indirect tax revenues so it is important to emphasize the importance of the characteristics and quality of data for valid analysis. In further research it is important to try to evaluate the results after the adjustment of data for structural breaks with some of standard econometric techniques such as dummy variables. Also, it is important to notice that our results suggest (contrary to theoretical assumptions) that increase in tax revenues on central government budget level results in growth of private aggregate demand for 13 quarters after the shock. Again, this result could be interpreted through the "confidence hypothesis" that states that in economies with relatively unstable public finance (such as Algeria) tax increase could represent a signal of political will and attempt of policy makers

to achieve prudential fiscal position. But, due to the fact that these results are not statistically significant there are no foundations for the discussion on the validity of this hypothesis. It is worth noticing that recent research based on regime-switching models shows that the size and movement of fiscal multipliers are strongly influenced

by the stage of the business cycle (eg Auerbach and Gorodnichenko, 2012), i.e. there are strong theoretical and empirical arguments that multipliers are higher in times of crisis. Since the Algerian economy has faced the crisis from 2014 to 2021 so (48% of the analyzed period) these findings are very important for discussion of our results. Also, since Algerian economy is operating in the surrounding of some form of liquidity trap and growing (and persistent) unemployment it is no surprising (from the theoretical point of view) that government expenditure (especially one that contains public investment) have strong and positive effect on economic activity. But it should be noticed that the fiscal multiplier in economic

literature is defined as the change in gross domestic product under the influence of selected fiscal variables, while in this study the effects of government revenue and expenditure on private aggregate demand are estimated, so it is important to observe the size of the fiscal multiplier in this context. To analyze statistical significance of our results, 95% and 68% confi dence interval

are used. Although 95% interval is mostly used level of confidence in the economic literature, characteristics, quality and the length of time series give firm foundation for using a "less certain" confidence level. Also, according to Sims and Zha (1999) it is a good idea to make one-standard-error intervals the norm, as they are likely to be closer to relevant range of uncertainty because the use of high-probability intervals the occurrence of large errors of over-coverage. One standard error interval is often used in determining the significance of the effects of fiscal policy in SVAR framework (eg. Caldara (2011); Mountford and Uhlig (2002); de Castro and Garotte (2012)).

The quality of the estimated model and the robustness of the results are tested in several ways. Firstly, it is important to repeat that the tests of the adequacy and stability of the model are satisfied. In all estimated models there are no problems of autocorrelation, heteroskedasticity and non-normality of residuals. All the roots of the characteristic polynomial are inside the unit circle, which means that the model meets the basic criteria of stability. To check the robustness of the model, standard starting point is

dividing analyzed series into two parts and estimating those models in each part separately. However, because of the very small time series, in this study the robustness has been tested by changes of the assumptions about elasticities as already mentioned, the SVAR models are quite sensitive to assumptions about elasticity. Results of the model are also tested by changing the assumption about the parameter b1 = 0 (inelastic government expenditure/spending on cycle) with an estimated elasticity of expenditures related to unemployment from Grdović Gnip (2011) b1 = -0.01. This change does not affect the basic conclusions. Also, in the identification scheme of the model it is assumed that tax revenues respond to the changes in government spending and not vice versa, that is β4 = 0. As in all studies which use the Blanchard-Perotti (2002) identification method, the assumption of the different direction of relation between those variables (i.e. β4 = 0) does not change the basic conclusions of the model.

Conclusion:

The results show that our hypothesis about the difference in the size of the multiplier of government expenditures and indirect tax revenues between three levels of government consolidation has been confirmed. The estimated values of multipliers correspond to results presented in the existing literature on the effects of fiscal policy in a closed economy framework. Although it is not possible to accurately determine the sources of these differences, it can be assumed that most of the differences are consequences of the greater use of capital expenditures, or public investments, on the consolidated level of central and general government level. This conclusion supports the findings of certain other studies that analyze the effect of individual components of government spending on economic growth in Algeria. Regardless of the above-mentioned limitations, the results of this paper could be of great importance for domestic literature on fiscal al policy. As it can be seen from public discussions, policy makers and economic agents in Algeria have great expectations from the government budget, which is mostly oriented on current expenditure. a time series data for revenues and expenditures of the consolidated general government restricts the analysis to only 53 observations. With three variables of interest and three exogenous variables (constant, trend and dummy variable) it represents a significant limitation in the context

of OLS and the CLT assumptions so it should be emphasized that obtained results are only indicative. To conclude, as already mentioned, stabilization function of fiscal policy is very important in time of economic recessions, especially in a small open economy with a managed exchange rate such as Algeria. So it is necessary to further explore the possibilities and limitations of fiscal policy measures in "macroeconomic management" of Algerian economy. The relevance of such studies is even greater in the context of the accession to EU, because monetary sovereignty and the possibilities of monetary policy will be further reduced. The model presented in this paper should be expanded in further research. It can be expanded by variables which will simulate the effects of important structural features of the Algerian economy, such as the openness of economy, exchange rate regime, the degree of indebtedness (public and external debt), capital market development, investor perception etc. However, the length of the time series and the comparability and quality of data will continue to be one of the major limitations in the analysis of the effects of fiscal policy in Algeria. Our goal is to continue this research using the assumptions about different characteristics of open economies, but on a larger sample of countries

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