The effect of fiscal multiplier on economy - case of Algeria

اثر المضاعف الضريبي على الاقتصاد حالة الجزائر

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Abstract: This research paper aimed to analyze the effects of fiscal policy on economic activity through the role of the tax multiplier of fiscal policy in Algeria. The standard segment is based on (SVAR) model attributed to (Blanchard-Perotti) that uses information on the institutional characteristics of the system, and the analysis is performed on quarterly data for total expenditures and indirect taxes for the central, unified, public, and overall unified government From 2004-2019. The results show that our initial assumptions about the difference in the size of the multiplier were confirmed by government expenditures and indirect tax revenue

Keywords: Fiscal Multiplier; Fiscal Policy ; SVAR model ; Algerian Economy

Résumé : Ce document visait à analyser les effets de la politique budgétaire sur l'activité économique à travers le rôle du multiplicateur fiscal de la politique budgétaire en Algérie. Le segment standard est basé sur le modèle (SVAR) attribué à (Blanchard-Perotti) qui utilise des informations sur les caractéristiques institutionnelles du système, et l'analyse est effectuée sur des données trimestrielles pour les dépenses totales et les impôts indirects pour le central, unifié, public, et gouvernement global unifié De 2004 à 2019. Les résultats montrent que nos hypothèses initiales concernant la différence de taille du multiplicateur ont été confirmées par les dépenses publiques et les recettes fiscales indirectes

Mots-clés : Multiplicateur fiscal ; Politique fiscale ; Model SVAR ; Economie Algérienne

ملخص: هدفت هذه الورقة البحثية إلى تحليل آثار السياسة المالية على النشاط الاقتصادي من خلال دور المضاعف الضريبي للسياسة المالية على الاقتصاد في الجزائر. ويعتمد الجزء القياسي على نموذج (SVAR) المنسوب إلى (Blanchard-Perotti) الذي يستخدم معلومات عن الخصائص المؤسسية للنظام ، ويتم إجراء التحليل على بيانات ربع سنوية لإجمالي النفقات

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والضرائب غير المباشرة للوسط والموحدة والعامة ، والحكومة الموحدة الشاملة من 2004-2019. توضح النتائج أن افتراضاتنا الأولية حول الفرق في حجم المضاعف قد تم تأكيدها من خلال الإنفاق الحكومي والإيرادات الضريبية غير المباشرة.

الكلمات المفتاحية : المضاعف الضريبي ;السياسة الضريبة ; نماذج (SVAR) ;الاقتصاد الجزائري

I- Introduction :

In neo-Keynesian models with flexible prices, expansions lead to higher prices that reduce the money supply and raise interest rates with the consequence that crowding out offsets the positive output effect. With fiscal contractions (Auerbach & Gorodnichenko ,2012, p27)[1]. , in contrast, crowding in offsets the negative output effect. Deficit reductions reduce prices and interest rates and, thus, improve the conditions for investment. In an open economy with capital mobility, higher interest rates attract capital from abroad. If exchange rates are flexible, the currency appreciates and crowding out is complete with rigid prices, but less with flexible prices since the appreciation lowers prices by (Blanchard & Perotti 2002 , p 1329)[2]

I.1. Literature review

In studying fiscal multipliers, many recent researches tend to confirm the sensitivity of those multipliers to the business cycle. Particularly, fiscal spending multipliers revealed to be larger in recessions than in expansions periods. were among the first studies that emphasized this tendency of fiscal multipliers to be large in recessions, which could reach values more than 2, compared to periods of economic expansion. Consequently, many other researches confirmed their results differentiating between fiscal multipliers in recessions and expansions Government Expenditure Multipliers. approach (Ramey & Shapiro, 1999 p 155)3 This also pushed other researches which leads to find out the vulnerability of fiscal multipliers to other determinants. Therefore, fiscal multipliers revealed to be dependent on the fiscal position measured by the level of debt ratios and deficits), on the monetary policy stance particularly the constrained monetary policy either by the zero lower bound interest rate (liquidity trap) or by the loss of monetary independence as in the pegged exchange rate or monetary union (Cogan and al.,). There are many motives why the size of the fiscal multiplier changes. Besides the proper characteristics of the studied economy which are obviously due to macroeconomic fundamentals (economic environment) as well as institutional

environment, the difference of methods and the accuracy of data have their important contribution on these differences. The degree of openness also plays an important role in this issue with more closed economy having larger fiscal multipliers than more opened ones. This happens particularly in the short run and incomplete financial markets as prices not fully adjusted push up the demand for home g, Ricardian equivalence, and credibility: If individuals shave rationale expectations, a continuous fiscal expansion leads them to expect a continuous rise in interest rates,IMF (2008, 2009, 2010, 2011)4 which discourages investment and may lead to negative multipliers. Similarly, with a credible fiscal consolidation individuals will expect a constant reduction of interest rates, which encourages investment and may significantly reduce the negative output effect of contractions and even turn it into a positive effect. Furthermore, when expenditures are reduced, individuals expect a reduction of future taxes, which increases their lifetime income (wealth) and leads to an increase of present consumption. Expectations may also in some cases lead to non contractionary effect of a tax increase. If consumers consider that a tax increase implies a regime shift(Caldara & Kamps 2012 p20)[5], they consider this as a one for all event and expect no more future wealth reducing tax increases and therefore keep consumption unchanged In the case of Ricardian equivalence, - which is closely linked to the concept of expectations-, if the government reduces taxes, the knowledge that governments have a fiscal constraint and are bound to rules oods which stimulates GDP growth

I .2. 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 STATA 14.

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 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 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 (Glynn & Perera ,2007,p 206)[1] and SVAR models are much more suitable for the analysis of shocks to aggregate demand side;. 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, household decisions on current spending can change in a relatively short time (within a quarter or two, except in the case of necessity products

II– Methods and Materials:

The procedure adopted in this methodology goes through three stages. First, it is necessary to study the stationarity of time series using the testing strategy Dickey and Fuller (1979, 1981) and Phillips –Pirron (1988) then, if all the series are made stationary, we estimate a VAR model with “p” delays and we apply the Granger causality test. The

data used come from the data bank of the World Bank and covers the period from 1970 to 2019

The adopted method consists in using a VAR model with three variables, considering the growth time adt series and Government spending gt and consumption, ct which are considred endogenous we can build a model of simultaneous structural equations to explain their behavior. Supposing that each variable depends on its delayed values and on the delayed values of the other three variables**.**

$$ADt = \alpha_{10} + \alpha_{11} AD_{t-1}$$

$$G_t = \beta_{10} + \beta_{11} AD_{t-1} + \cdots + \beta_{1P} AD_{t-P} \beta_{21} X_{t-1} + .. + \beta_{2P} G_{t-P} + \beta_{3P} C_{t-P} + .. + \beta_{3P} C_{t-P} + e_{2t} \quad (2)$$

$$C_t = \gamma_{10} + \gamma_{11} AD_{t-1} + \cdots + \gamma_{1P} AD_{t-P} \gamma_{21} G_{t-1} + .. + \gamma_{2P} G_{t-P} + \gamma_{3P} C_{t-P} + .. + \gamma_{3P} C_{t-P} + e_{2t} \quad (3)$$

These equations define a VAR model, because in general such a model expresses the current values of endogenous variables only as a function of a constant and delayed values of endogenous variables. The number of delayed values determines the order of the VAR model and the terminology imply that this model is an extension of the time series with autoregressive process of order p (AR (P)) which can be explained by formulating the vector by the following equation:

$$Z_t = \Psi + \Phi_1 Z_{t-1} + \Phi_2 Z_{t-2} + \cdots + \Phi_3 Z_{t-P} + U_t \quad (4)$$

The estimation of such a model supposes the stationarity of the different variables. This means that the random vector Yt has a constant expectation E(Yt) =μ over time and the covariance matrices between Yt and Yt + h depends only h and not a time (h = 0.1,…), which means for h = 0, cov (Yt) is constant

It should be noted that in practice these hypotheses mean that the time series do not have trend seasonality and nor variances which change over time, to realize these hypotheses, or these conditions, some transformations on the data are necessary

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

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

$$ad_t = c_1 t_1 + c_2 g_t + \beta_5 e_t^{AD}$$

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

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

which gives a form Aut = Be t of SVAR model. In order for this system to be identified

, it is necessary to set 2K2 – K – 1 – 2K(K + 1) restrictions that preferably have a basis in the economic theory. Since the number of endogenous variables is K=3,

(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 (De Castro & De Cos ,2006 , p166)[2], , 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 estimation(Giordano et all,2005,p 288)[3] , 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 β2 and β4 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 β4 = 0. Regarding the mentioned restrictions, the final form of the SVAR model, is as follows:

$$\begin{bmatrix} 1 & 0 & -1.05 \\ 0 & 1 & b_1 \\ c_1 & c_2 & 1 \end{bmatrix} \begin{bmatrix} c_t \\ g_t \\ ad_t \end{bmatrix} = \begin{bmatrix} \beta_1 & \beta_2 & 0 \\ \beta_4 & \beta_3 & 0 \\ 0 & 0 & \beta_5 \end{bmatrix} \begin{bmatrix} e_t^T \\ e_t^G \\ e_t^{AD} \end{bmatrix}$$

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..

III- 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 Uhlig ,2002 ,p 31)[4] and(Bretscher et al 2016, p5)[5] 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 for mathematical derivation

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 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 significant effects of government spending at the central government budget level, where characteristics 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

are used. Although 95% interval is mostly used level of confidence in the economic literature, , 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 camouflage 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. Krittin,2013, p 48)[6]

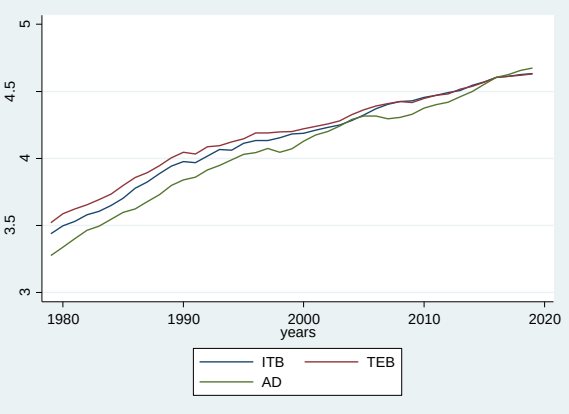
the SVAR models are quite sensitive to assumptions about elasticity. Results of the model are also tested by changing the assumption about the parameter b1 = 0 (inelastic government expenditure/spending on cycle) with an estimated elasticity of expenditures related to unemployment from (Selcuk et al 2019 p 12)[7] 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 (Mustafa et al 2019 p 31)[8] 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

IV- Conclusion:

W e can 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.

V- Appendices:

Figure(1): Government expenditures, indirect taxes and private AD in Algeria 2004-2018 (10^9 dzd)



source: Prepared by researcher using STATA 14

Table(1): Fiscal multipliers in Algeria 2004q1-2017q4

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 expenditure			
High	0.98(q2)**	1.20(q2)**	1.39(q2)**
Low	0.17(q16)	0.19(q16)	1.19(q16)
Reversed sign			

Tax	From q3 to q16	-	-
Government expenditure	q1***	q1	-

source: Prepared by researcher using STATA 14

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