

THE IMPACT OF FISCAL POLICY ON ECONOMIC GROWTH IN ALGERIA: EMPIRICAL STUDY USING SVAR MODEL

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SUMMARY

This study aims to analyze the impact of fiscal policy on economic growth in Algeria using the Autoregressive Structural Vector Methodology (SVAR), we will follow the method of working of Blanchard and Perotti (2002). We include only three variables: public spending G, Taxes (Direct taxes + Indirect taxes) TAX and GDP. The study concluded that there is a positive effect of public spending on the economic growth in Algeria, but it is smaller, and it is only in the short term and then turns into a negative impact in the medium and long term. This indicates that ordinary taxation is very limited to increase economic growth in Algeria with the strong presence of petroleum taxation. When a negative shock occurs in the price of a barrel then the effect is transferred directly to the public revenues and automatically to the public spending.

KEY WORDS: Fiscal policy; economic growth; public spending; Taxes; SVAR model.

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تأثير السياسة المالية على النمو الاقتصادي في الجزائر: دراسة تطبيقية باستخدام نموذج SVAR

ملخص

تهدف هذه الدراسة إلى تحليل تأثير السياسة المالية على النمو الاقتصادي في الجزائر باستخدام منهجية (SVAR)، وسوف نتبع طريقة عمل Blanchard and Perotti 2002. تم ادراج ثلاثة متغيرات فقط: الإنفاق العام G والضرائب (الضرائب المباشرة + الضرائب غير المباشرة) والنتائج المحلي الإجمالي. كانت النتائج على النحو التالي، تأثير موجب للإنفاق العام على النمو الاقتصادي في الجزائر، لكنه ضعيف، وهو فقط على المدى القصير ثم يتحول إلى تأثير سالب على المدى المتوسط والمدى الطويل، هذا يدل على أن الجباية العادية يبقى تأثيرها محدود وديز يادة النمو الاقتصادي في الجزائر معتمو يلقو بللجباية البترولية، فعندما تحدث صدمة سلبية في سعر البرميل ينتقلا لأثر مباشرة إلى الإيرادات العامة ومنتم الإنفاق العام تلقائيا.

كلمات المفتاحية: سياسة مالية، نمو اقتصادي، انفاق عام، ضرائب، نموذج SVAR.

L'IMPACT DE LA POLITIQUE BUDGETAIRE SUR LA CROISSANCE ÉCONOMIQUE EN ALGÉRIE : ETUDE EMPIRIQUE UTILISANT LE MODÈLE SVAR.

RÉSUMÉ

Cette étude vise à analyser l'impact de la politique budgétaire sur la croissance économique en Algérie à l'aide de la méthodologie des vecteurs structurels autorégressifs (SVAR), nous suivrons la méthode de travail de Blanchard et Perotti (2002). Nous n'incluons que trois variables: les dépenses publiques G, Impôts (impôts directs + impôts indirects) et PIB. L'étude a conclu qu'il y a un effet positif des dépenses publiques sur la croissance économique en Algérie, mais il est plus petit, et ce n'est qu'à court terme et se transforme ensuite en impact négatif à moyen et long terme. Cela indique que la fiscalité ordinaire est très limitée pour accroître la croissance économique en Algérie avec la forte présence de la fiscalité pétrolière. Lorsqu'un choc négatif se produit sur le prix du baril, l'effet est transféré directement aux recettes publiques et automatiquement aux dépenses publiques.

KEY WORDS : Politique budgétaire; croissance économique; dépense publique; Les impôts; Modèle SVAR.

INTRODUCTION

Developments in the world over the last half of the last century, in particular those linked to the global economic and financial crises, which have had a significant impact on the increase in the volume of external debt, debt service public policy, the budget deficit and the imbalance of payments for the various countries, played a major role in transforming the role of fiscal policy. The change in its concept and its functioning, starting with the emergence of Keynesian thought which called for the need for state intervention through macroeconomic policies; in order to combat economic stagnation, achieve stability and growth; all this required various changes in the area of monetary and fiscal policy, which led to the development of

methods, tools and objectives of fiscal and monetary policy, which played a major role in the evolution of countries' perception of fiscal policy.

Fiscal policy is an analytical study of public sector financial activity and the effects that this activity will have on different sectors of the national economy. It includes, among its content, a quantitative adjustment of the volume of public expenditure and public revenue, as well as a qualitative adjustment of the aspects of these expenditures and the sources of these revenues in order to achieve certain objectives, first and foremost economic growth and social justice.

Fiscal policy gets its importance from its tools, because public spending affects national economic activity, because it affects consumption, savings, investment and income, which represent the resources that the State obtains to cover its expenditure, and the more the income and investments of the state increase, the more the economic growth of the state goes up .

Fiscal policy in Algeria, during the planning stage, was characterized by the presence of a strong public sector in the economic arena, which relied on central planning as a method of economic development, which necessitated a strong intervention of the public sector in economic matters, which emerged clearly through the rise in public spending in the state's general budget. Algeria is applying a contractionary fiscal policy in the event of a decline in the price of a barrel of oil, due to the weak coverage of ordinary taxation. And it goes back to adopting an expansionary fiscal policy of a Keynesian nature when barrel prices rise again.

The study aims to test whether fiscal policy has an impact on the economic growth in Algeria, and therefore, the study aims to address the following problem:

What is the effect of fiscal policy variables on the economic growth in the short and long term? What is the nature of this effect in the case of the Algerian economy?

In this context, we will make two hypotheses:

The first hypothesis: Public spending in Algeria contributes to increasing economic growth.

The second hypothesis: Ordinary taxation in Algeria contributes negatively on economic growth.

In this study, we will use the Autoregressive Structural Vector Methodology (SVAR), we will follow the method of working of Blanchard and Perotti (2002). We include only three variables: public spending G , Taxes (Direct taxes + Indirect taxes) TAX and GDP .

1- EMPIRICAL LITERATURE

The approach of structurally independent vector models (SVAR) presented by Blanchard and Perotti, define automatic stabilizers by incorporating external information about income elasticity and expenditures related to GDP . In their essay, they analyzed the US economy between 1960 and 1997 and found that expansionary budget shocks increase production by a long-term fiscal multiplier close to unity. In addition, they found negative effects of increased taxes and investment spending. This approach has been developed in many modern works, the most famous being Perotti. ((Blanchard & Perotti, 2002)

Approaching the above studies, some applied country studies were conducted despite their relative scarcity due to the limited availability of quarterly financial statements. For example, Perotti (2005) analyzed the effects of fiscal policy in 5 OECD countries and found that: the impact of fiscal policy on GDP is small, there is no conclusive evidence that Tax cuts have a quick and effective impact compared to increasing public spending, there is a relatively large positive impact on private consumption and there is no impact on private investment. There is a small positive effect of public spending on long-term interest rates. There is a small impact of public spending on price levels. (Perotti, 2005). The case of France, Biau and Girard found a cumulative multiplier of public spending of 1.4 with positive reactions for both private consumption and private investment, while the increase in public revenue will have negative effects in the short term (the multiplier approaches -0.1) especially On private consumption. (Biau & Girard, 2004)

The case of Spain, De Castro and Hernández De Cos found a positive relationship between public spending and GDP in the short term only, while in the medium and long term, expansionary shocks will lead to higher inflation and a fall in the GDP. The increase in taxes will lead to a drop in economic activity in the medium term with a temporary improvement in the balance sheet. (Hernandez, 2006)

The case of Germany Heppke-Falk et al found that a positive shock in public spending would have a positive impact on GDP and private consumption, although this effect was relatively small and the impact of high taxes was negative for GDP and consumption private. (Heppke-Falk, Tenhofen, & Wolff, 2010)

The case of Italy Giordano et al found that a shock in public purchases of goods and services of 1% would lead to an increase in GDP by 0.6% after three quarters, this effect will not be eliminated after two years, and the effect has also been positive on employment, consumption and private investment. However, the reaction to inflation has been positive, but weak and short term. General wages, on the other hand, had no gross product, with a negative impact on employment after the end of the Quartet. Although income shocks did not have a significant effect on all variables. (Giordano, Momigliano, Neri, & Perotti, 2007)

In the case of Portugal Afonso and Sousa found that public spending shocks generally have a negative impact on real GDP due to their negative impact on consumption and private investment, and have a lasting positive effect on the level prices and the average cost of financing public debt. When revenue shocks have a negative impact on real GDP and cause the price level to fall. (Afonso & Sousa, 2009a)

Afonso and Sousa also released the first study in the United States, the United Kingdom, Germany and Italy and concluded that public expenditure shocks have a small effect on aggregate output and have negative effects on important foreclosure, and it also has a changing impact on house prices, and generates a rapid collapse in stock prices. While the shocks to government revenues have had a weak and

positive impact on both house prices and stock prices with an increase in the value of the real exchange rate.(Afonso & Sousa, 2009b)

In summary, all the studies which use the BP identification scheme find a small positive fiscal multiplier for government spending increases, while Afonso and Sousa estimate a small but negative effect based on a Cholesky identification.

The most important previous studies of the case of Algeria:

- The impact of fiscal policy on economic activity over the business cycle: an empirical investigation in the case of Algeria. The study concluded that, the fiscal policy shocks in Algeria affect more in the economic recession and less during boom periods, and the hypothesis of unequal effects on the Algerian economy was confirmed. (Chibi, Chekouri, & Benbouziane, 2019)
- The Fiscal-Monetary Policy and Economic Growth in Algeria: VECM Approach. The study concluded that in the long-run, the impact of government expenditures is positive, while the effect of taxes is negative on growth. And find that the inflation rate is found to have little effect on GDP per capita but the impact of the exchange rate is insignificant. So conclude that fiscal policy is more powerful than monetary policy in promoting economic growth in Algeria.(Bkreta & Benanya, 2016)
- The impact of fiscal policy on economic growth: empirical evidence from panel estimation. The study found that the effect of fiscal policy in North African and Middle Eastern countries on economic growth and stability remains, and thus public spending is still considered an important variable in building macroeconomic policies in these countries.(Benanya, Rouski, Toumache, & Talbi, 2014).

2- ALGERIAN FISCAL POLICY

2.1- The post-independence period

European settlers leaving Algeria after independence caused a significant drop in economic activity and thus a decrease in tax revenue. This prompted Algeria at that time to search for compensatory financial resources to fill the deficit in the public

treasury, by imposing new financial measures represented in increasing customs duties and adopting the tax on wages and salaries (ITS). The tax rate has been increased to an average of about 20% of public revenue during this period. A single total tax was imposed on the production of TUGP, with high indirect tax rates for luxury items, as this proportion was about 22.6% on average of total income, 11.9% in 1963 to 27.9% in 1969. As for fiscal pressure, it increased from 19% in 1963 to 26% in 1969.

As for public spending, it showed Algeria's desire to achieve economic independence after achieving political independence from France, but this was difficult to achieve due to the fragility of the Algerian young economy. The public spending ratio has stabilized 20 to 25%, with most of these expenditures covering operating expenses (more than 80% of total public spending). (ONS & Rétrospective 1962-2011, 2011)

2.2- Planning period

During this period, Algerian fiscal policy relied heavily on petroleum taxation, which increased from 24.7% of total revenue in 1970 to about 50% of this total in 1985. Ordinary taxation also witnessed a clear decline, more than 75% of the total income in 1970 to about 50% in 1985, and the weakest level in 1981 reached 33.6%. With the relative increase in the applied tax rates, in particular the TUGP and the adjustment of the scale to calculate the value of ITS, as well as the amendment of the tax on industrial and commercial profits (BIC).

After the collapse of barrel prices in 1986, the proceeds of petroleum collection decreased by about 20% (from 50% in 1985 to 30% in 1986). This had a direct impact on the country's total revenue, as it also moved from 38% of GDP during the period 1981-1985 to 28% of this total during the period 1986-1990. This stage witnessed a great interference by the state in the economy, and this is a result of the nature of the economic system adopted by Algeria, which is the socialist approach, and as an inevitable consequence that public spending in Algeria has increased from 25.98% of the GDP in 1967 to about 43% of the GDP The year 1986. Algeria during this period

directed its financial policy towards increasing investment spending, relying to achieve this on increasing petroleum taxation during that period. (ONS & Rétrospective 1962-2011, 2011)

2.3- Transition period (1991-1998)

Since the beginning of the nineties (1990s), Algeria has embarked on a set of economic reforms, the most important of which is to reduce the dependence of fiscal policy on petroleum taxation, and the need to reactivate the role of regular taxation through the reform of the tax system of 1992. The outcome of regular taxation after tax reform is defined as a decrease if we compare it at least with the post-crisis period 1987-1990. It continued to decline, from 41.47% in 1993 to about 29.93% in 2004. Also, in Algeria's regular collection structure, indirect taxes come first, rising from 2.8% of total revenue in 1992 to 16.9% of this total in 1993, and peaking in 1998 by 20%.

There was an increase in public spending in 1992 and 1993, which amounted to about 40% of GDP on average, and this increase is due to an increase in wages, salaries and spending on social networks from February 1992, as it rose from 71 billion Algerian dinars in 1991 to 114.9 billion Algerian dinars in 1993, in addition to increasing spending on financial cleansing of public institutions.

Public spending in Algeria witnessed a significant decrease by 6.1% from 1993 to 1998 due to the approved structural reforms imposed by the international loan institutions (IMF, The World Bank) through the implementation of the structural adjustment program and its rigor. The most important characteristic of this stage is the high level of the state's public debt due to the high volume of external debt and the adoption of a policy of financial cleansing of incapacitated institutions, reaching 98.9% of the GDP produced in 1995. (World bank report n°36270.DZ, 2007)

2.4- Period of 1999-2018

The return of high fuel prices from the last trio in 1999 added some financial comfort to this period, which was used to stimulate economic activity through financial development policy, expressed by volume. High public spending under the so-called economic stimulus

support program, so that the proportion of public spending has increased from GDP 28.31% in 2000 to around 34.87% in 2003. (World bank report n°36270.DZ, 2007) The amount of 155 billion USD approved outside the state budget to finance this program clearly expresses the state's desire to pursue a Keynesian development budget policy aimed at stimulating Macro demand through projects of stimulating investment General. (Ministry of Finance, 1999-2011) Financial policy has contributed significantly to the improvement of some of the surface macroeconomic indicators, perhaps the most important of which was the reduction in the volume of external debt to the limits of 4.88 billion USD in 2007, and the high economic growth rates at acceptable levels, reaching 6.8% in 2003. (IMF, 2012).

Although declining, hydrocarbon revenues still constitute the largest share of public revenues, making Algerian fiscal policy vulnerable to volatile oil prices. The decline in prices led to a drop in hydrocarbon revenues, which went from 14.3% of GDP in 2015 to 10.4% in 2016; at the same time, non-hydrocarbon revenues increased and constituted, in 2016, 19.1% of GDP against 16.5% in 2015. (ONS, Finance publique 2012-2015, 2015) The fall in oil revenues led to the virtual exhaustion of public savings held by the Algerian Fund Revenue Regulation (FRR), which contracted, going from a peak of 43% of GDP in 2009 to 4.2% in February 2016 (740 billion DZD, the mandatory legal threshold). Measures are currently being implemented to mitigate the impact of low public revenues. The 2016 finance law approved a 9% drop in spending and a 4% increase in budget revenue based on a 36% rise in fuel prices, an increase in VAT on fuels and electricity, and an increased vehicle registration fees. The expenditure part of the budget provides, in particular, for a 0.6% drop in current expenditure and a sharp 14.6% drop in equipment expenditure. (World Bank, Algeria's economic situation monitoring report, 2017).

Budgetary deficits fell in 2018, reaching 7.6% and 4.9% of GDP respectively, compared to 8.8% and 6.9% of GDP the previous year. This improvement is explained by a slight increase in revenue,

associated with a reduction in spending on goods, services and wages, as well as in capital spending. Inflation remained stable at 4.3% in 2018, despite the expansionary monetary policy pursued as part of the central bank's "unconventional financing" measures, representing 32 % of GDP, half of which has already been injected into the economy. Deficit budget could, however lead to strong money creation, authorities have so far refused to finance the deficit by borrowing from abroad. (World Bank, Algeria Economic outlook, 2018)

3- METHODS AND MATERIALS

3.1- Theoretical Framework and Methodology

Compared to the simultaneous equations (basis of macro-econometrics until the 1970s), the VAR model has the advantage of capturing the variation of the parameters of the model (system of equations) over time, and thus makes it possible to better restore the dynamics of the system, which gives credibility to economic policy (macroeconomic forecasts) which adjusts and adapts to variations or shocks (innovations) experienced by the socio-economic environment. (Bourbonnais, 2002)

However, not taking into account the hypothesis of simultaneous effects between variables makes the VAR pass for an a-theoretical model (devoid of economic foundation), not restoring economic reality, likely to bias economic policy. The VAR model is based on hypotheses identifying the equations to be estimated which have no theoretical (economic) basis. This constitutes the great weakness of the VAR models, which weakness has aroused criticism to the point of leading to the development of the so-called "structural" VAR models, namely the SVARs, which constitute a remedy as far as they make it possible to predict the effects of changes. That we identify (known decisions or policies) in the socio-economic environment, shocks or innovations are no longer random or unidentified their origin is known or identified. (Ocampo & Rodriguez, 2012)

3.2- SVAR (Structural Vector Auto-Regressive) modeling

In recent years, the Autoregressive Structural Vector Methodology (SVAR) has become widely used, providing a natural methodology for examining whether temporary fiscal stimulus plans such as those implemented by several OECD countries during the recent global recession, have positive or negative effects on production and for how long. A particular advantage of the methodology is that it allows feedback effects from one fiscal (and sometimes monetary) variable on another; for example, when an increase in public spending stimulates production, which in turn affects tax revenue. A resulting disadvantage is that it cannot generally identify the ceteris paribus effects of changes in the components of individual tax expenditures.

More than standard VAR models, structural VAR models help to:

- Enter the responses of the system variables to the structural shocks identified (data);
- Using the decomposition of the variance of the forecast error, assess the average share of a given structural shock in the dynamics (variation) of the variables;
- Evaluate the cumulative share over a period of a given shock in the dynamics of each variable of the model, thanks to the historical decompositions provided;
- Do simulations or scenarios on the future states or conditions of the variables according to the probable future structural shocks.

To understand how the SVAR model works, we will start with a simple or standard VAR whose primitive and reduced forms are as follows:

Primitive form:

$$AY_t = \lambda + \sum_{i=1}^p B_i Y_{t-i} + u_t \dots \dots \dots 1$$

Reduced form:

$$Y_t = A^{-1}\lambda + \sum_{i=1}^p A^{-1}B_i Y_{t-i} + A^{-1}u_t \dots \dots \dots 2$$

To generalize the relation 2 that is the reduced form, let's write it like this:

$$Y_t = \pi + \sum_{i=1}^p \phi_i Y_{t-i} + e_t \dots \dots \dots 3$$

With : $\pi = A^{-1}\lambda$; $\phi_i = A^{-1}B_i$; $e_t = A^{-1}u_t$.(Kilian, 2011)

In this context, we find the identification procedure developed by Blanchard and Perotti. Three macroeconomic variables are included in the model: GDP, public spending and taxes. We can give a brief concept of each variable.

- Gross domestic product GDP, Economic growth quantifies the change in output in an economy over a period of time. This positive variation is measured by the annual evolution of the GDP.(Alphandery, 1993)
- Economically, public spending can be either expenditure on the production of collective goods and services, or distribution or transfer expenditure (social assistance, pensions or allowances, subsidies to the economy, debt service), or even consumer spending. The goal of public spending is to meet the collective needs of the nation that private activity alone cannot cover effectively: security, order, health, education, etc.(Muzellec, 1995)
- Taxation encompasses all the tax regulations in force in a country, as well as the practices employed by its tax administration to recover compulsory deductions.(Muzellec, 1995)

In the SVAR representation $A\mu_t = B\varepsilon_t$, $\mu_t = (GDP_t, G_t, TAX_t)$ is the vector of reduced form error terms for GDP, public expenditure and taxes, respectively. The vector of structural shocks is given with $\varepsilon_t = (\varepsilon_t^{GDP}, \varepsilon_t^G, \varepsilon_t^{TAX})$ with $Cov(\varepsilon_t) = I_3$ and ε_t^{GDP} , ε_t^G and ε_t^{TAX} corresponding to the GDP, taxes and expenditure shocks. After estimating the reduced form VAR, we can use the reduced form residues μ_t to determine the elements of A and B.

Public spending G, Taxes revenue TAX, and a structural shock to GDP itself, with these assumptions, we can write:

$$TAX_t = a_1 \varepsilon_t^{GDP} + a_2 \varepsilon_t^G + \varepsilon_t^{TAX}$$

$$G_t = b_1 \varepsilon_t^{\text{GDP}} + b_2 \varepsilon_t^{\text{TAX}} + \varepsilon_t^{\text{G}}$$

$$\text{GDP}_t = c_1 \varepsilon_t^{\text{TAX}} + c_2 \varepsilon_t^{\text{G}} + \varepsilon_t^{\text{GDP}}$$

We can reorganize this system to reconstruct the AB representation: $\bar{A} \mu_t = B \varepsilon_t$, with:

$$\bar{A} = \begin{pmatrix} 1 & 0 & -a_1 \\ 0 & 1 & -b_1 \\ -c_1 & -c_2 & 1 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & a_2 & 0 \\ b_2 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Use of information on the tax and transfer system to determine the coefficients \bar{A} and B, Blanchard and Perotti apply the following procedure:

- First, institutional information on the German public finance system is used to identify the coefficients a_1 and b_1 . We must consider that the two coefficients integrate two distinct effects of activity on spending and taxes. They capture the automatic stabilizers, which are the automatic effects of economic activity on the fiscal variables of fiscal institutions. In addition, they grasp any discretionary adjustment in fiscal policy to unexpected exogenous changes in economic activity in the same quarter. As long as we assume that it takes fiscal policy to respond for some time to changes in GDP due to democratic, legislative and bureaucratic processes in decision-making and implementation, the use of quarterly data basically eliminates the second channel. It is therefore valid to assume that a_1 and b_1 capture only the automatic responses of budgetary variables to GDP. They are calculated using the OECD framework of Girouard and André. For the overall elasticity of the N tax series with respect to production, Girouard and André apply the following formula:

$$a_1 = \sum_{i=1}^N \mu_{\text{TAX}_i} B_i \text{GDP} \frac{\overline{\text{TAX}}_i}{\overline{\text{TAX}}}$$

$$a_1 = \sum_{i=1}^N \mu_{\text{TAX}_i} B_i \text{GDP} \frac{\overline{\text{TAX}}_i}{\overline{\text{TAX}}}$$

- Where \overline{TAX} are net taxes, with $\overline{TAX} = \sum_i N_i \overline{TAX}_i$ and \overline{TAX}_i being type i taxes, which take a positive value for taxes and a negative value for transfers. $\mu_{TAX_i B_i}$ indicate the elasticity of TAX_i with respect to its tax base B_i and $\mu_{B_i GDP}$ represents the elasticity of the tax base to GDP.
- In the second step, we construct the contemporary influence of income and expenditure on GDP, c_1 and c_2 . With the estimates of a_1 , b_1 the reduced-form fiscal policy shocks corrected for cyclical variations (residual income and expenditure) are calculated with $TAX_t = TAX_{a_1} GDP_t$ and $G_t = G_t - b_1 GDP_t$.
- In the final step, the remaining parameters a_2 and b_2 must be determined. In the literature, it is controversial to know whether taxation follows expenditure $b_2 = 0$ or whether expenditure follows taxation $a_2 = 0$ (see for example Kollias and Paleologou, Hoover and Sheffrin 1992 or Koren and Stiassny 1998). In the reference model, a_2 is constrained to zero and b_2 is estimated (income decisions come first).
- The time-varying elasticity of a_1 with a mean around one and the identification described produce the following matrices of contemporary relations for the linear and nonlinear model. (Baum & Koester, 2011).

3.3- Impulse analysis Sim (1980, 1981) and decomposition of variance

The causal results guide the analysis of impulse responses, which consists of observing the reaction of the other variables of the model following variations (shocks) on a variable (innovation) of the system. If we consider our VAR (1): $X_t = \alpha + AX_{t-1} + \mu_t \dots$ and admit a variation at time "t = 0", we will note: μ_0 (the shock) and: $\mu_q = 0$ ($q = 1 \dots t$) absence of shocks. In this logic, we will verify that:

$$\left\{ \begin{array}{l} \text{at the time 0 : } X_0 = \mu_0 \\ \text{at the time 1 : } X_1 = AX_0 \\ \text{at the time 2: } X_2 = AX_1 = A^2X_0 \\ \quad \quad \quad \cdot \\ \quad \quad \quad \cdot \\ \quad \quad \quad \cdot \\ \text{at the time } t: X_t = A^tX_0 \end{array} \right.$$

If the shock μ_0 relates to the 1st variable, we will have $\mu'_t = (1,0, \dots, 0)$. The 1st column will A^t translate the effects of the shock given to the 1st variable on the system after t periods. The impulse response function will consist of a series of system reactions to an individual shock on the innovations of the model. These reactions are given by the coefficient C_k calculated as follows:

$$C_k = \frac{\partial X_{t+k}}{\partial \mu'_t}$$

With $X_k = C(L)\mu_t$; $C(L) = (I - AL)^{-1}$, and $C(1)$: total effect. Columns of C are often normalized by the standard deviation of μ_t .

If we accept the decomposition of the variance-covariance matrix into: $\Sigma, \Sigma = QQ', MA(\infty)$ can be written:

$$X_t = \eta + C(L)\mu_t = \eta + \sum_{q=0}^{\infty} C_q QQ^{-1}\mu_{t-q} = \sum_{q=0}^{\infty} \phi_q e_{t-q}$$

Where: $\phi_q = C_qQ$: effects on the system of an independent and standardized shock on the error of a variable after t periods, and $e_t = Q^{-1}\mu_t$: the variance-covariance matrix of μ_t is identity. (Kilian, 2011)

3.4- Empirical Analysis (Investigation of the case of Algeria)

In this study, we will follow the method of working of Blanchard and Perotti whose content we have mentioned in detail previously. We include only three variables: public spending G , Taxes (Direct taxes + Indirect taxes) TAX and GDP . The data is compiled from national office of statistics (ONS), Ministry of Finance, WDI and IFS. In particular, the former generally focus on temporary fiscal policy "shocks", using quarterly data. So we have converted the annual data

to the corresponding quarterly data using cubic spline interpolation method. The data covers the period 1970 to 2018, we have chosen this period because it is sufficient for economic and econometric analysis. It brought together all the economic transformations that have affected fiscal policy in the Algerian economy. In addition to the availability of statistics related to the variables of the study.

As is customary when using time series, especially in the analysis of country situations, we will start by testing the stability of the time series of the variables included in the analysis, using the improved Dicky-Fuller test for unit roots (ADF), in this regard, and after calculating the number of delays on the basis of the smallest value. It is taken by the coefficient Akcaike and Schwarz. The results of the time series stability test for the study variables showed that these chains are unstable for all the levels of variables used, which led us to take the test on the first differences. The results of this test were as presented in table n° 1.

Table 1. Unit Root test (ADF)

Vs	level			1st difference			Order of integ
	Intercept	Trend intercept	None	Intercept	Trend intercept	None	
GDP	-2.73 (0.57)	-1.10 (0.91)	-2.77 (0.70)	-6.31 (0.00)	-6.49 (0.00)	-6.43 (0.00)	I(1)
G	-2.49 (0.12)	-2.57 (0.29)	-0.76 (0.37)	-6.02 (0.00)	-5.93 (0.00)	-6.07 (0.00)	I(1)
TAX	-1.61 (0.46)	-1.51 (0.80)	-0.29 (0.57)	-5.3245 (0.00)	-5.26 (0.00)	-5.40 (0.00)	I(1)

Critical value 5% : ADF:-1,950394 , () probability

Source: Eviews program outputs

From table n° 2, It is clear that the values λ_{trace} below the critical values are at the level of significance of 5% and we therefore accept the numerical hypothesis H0, that is to say that there exists a relation synchronous integration, because the number of vectors of synchronous integration is $r = 3$ at the level of significance of 5%, which indicates the presence of long-term equilibrium relationships

Among certain variables, that is to say that they do not move away from each other in the long term so that they exhibit similar behavior.

Table 2. Co-integration test

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob**
None *	0.661026	77.68600	29.79707	0.0000
At most 1 *	0.503186	40.90376	15.49471	0.0000
At most 2 *	0.395596	17.11943	3.841466	0.0000

trace test indicates 3 co-integrating eqn(s) at the 0.05 level

*de notes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Eviews program outputs

The specification includes a constant and one lag of the endogenous variables according to the Schwarz information criteria. As for the case of linear VAR model, to identify structural shocks we need to transform the matrix of variance and covariance of residuals into an identical one. For this purpose a set of restrictions have to be imposed. In this case we use the Cholesky identification, which consists of ordering the variables from the most exogenous to the most endogenous in the system. The variables are ordered as Taxes (Direct taxes + Indirect taxes), public spending, and GDP table n° 3, then we will determine the transition matrix, based on the calculation of elasticities, see table n° 4.

Table 3. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-349.7378	NA	206015.1	20.74928	20.88396	20.79521
1	-311.1631	68.07314*	36288.09*	19.00959*	19.54831*	19.19331*
2	-307.9267	5.140118	51684.31	19.34863	20.29138	19.67013
3	-302.0346	8.318261	64313.00	19.53145	20.87824	19.99074

Source: Eviews program outputs

Table 4. Calculated Elasticities

	Elasticity with respect to GDP	Average share in revenues 1970-2018	Weighted elasticity
Direct taxes	0.448	0.75	0.336
Indirect taxes	0.36	0.40	0.144
Elasticity net revenues	-	-	0.480

Application of formula: $a_1 = \sum_{i=1}^N \mu \text{TAX}_i B_i \text{GDP} \frac{\overline{\text{TAX}}_i}{\overline{\text{TAX}}}$
 $a_1 = 0.480$

Source: Eviews program output

Estimated transition matrix: Structural VAR Estimates (With the help of Eviews program)

$$\bar{A} = \begin{pmatrix} 1 & 0 & -a_1 \\ 0 & 1 & -b_1 \\ -c_1 & -c_2 & 1 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & a_2 & 0 \\ b_2 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$b_1; b_2$: estimate the coefficients with residual variance estimate.

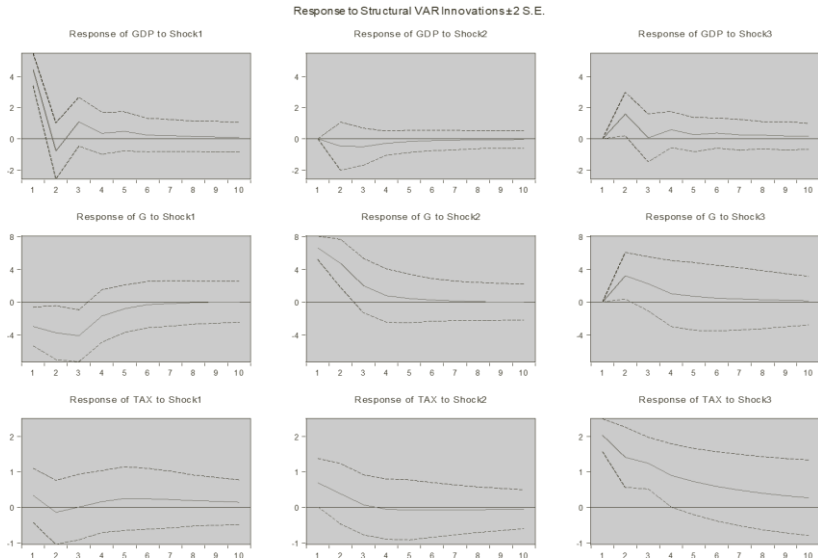
$c_1 ; c_2$: estimate the coefficients with a least squares estimate.

$$\bar{A} = \begin{pmatrix} 1 & 0 & -0.480 \\ 0 & 1 & -0.054 \\ -0.323 & -0.171 & 1 \end{pmatrix}$$

$$B = \begin{pmatrix} 1 & 0.142 & 0 \\ 0.112 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The dynamics of the SVAR model will then allow us to obtain the growth rate (GDP) value at each instant following the initial shock, and thanks to this transformation we have obtained all the dynamic growth rate (GDP) responses resulting from a structural shock estimated by one unit across all the independent variables of the model (Figure n°1).

Figure 1. Impulse responses



Source: Eviews program outputs

The analysis of variance decomposition will allow us to clarify the role of each shock in the interpretation of situational growth rate (GDP) fluctuations table n°5.

Table 5. Variance

Variance Decomposition of	GDP	S.E.	GDP	G	TAX
1		14.03801	100.0000	0.000000	0.000000
2		15.63107	99.33840	0.020575	0.641022
3		16.72401	97.51220	0.723634	1.764163
4		17.43184	96.30232	1.696272	2.001404
5		18.03220	95.28560	2.707018	2.007377
6		18.53988	94.58371	3.510103	1.906191
7		18.97238	94.07022	4.105668	1.824108
8		19.33051	93.69426	4.521992	1.783751
9		19.61975	93.41511	4.810416	1.774474
10		19.84799	93.20641	5.008991	1.784601

Source: Eviews program output

4- RESULTS AND DISCUSSION

4.1- Impulse responses Results

The dynamics of the SVAR model will then allow us to obtain the growth rate (GDP) value at each instant following the initial shock, and thanks to this transformation we have obtained all the dynamic growth rate (GDP) responses resulting from a structural shock estimated by one unit across all the independent variables of the model. The analysis of variance decomposition will allow us to clarify the role of each shock in the interpretation of situational growth rate (GDP) fluctuations.

According to the estimates of the 10 year batch response functions described in figure n° 1, a single positive structural shock of public spending G estimated at 1% will have a significant positive effect on GDP in the short term until the second year after the shock (+ 1.2938%), in the medium term, a significant negative effect will be generated from the fourth year after the shock (- 0.3452%) will soon result in a greater negative impact from the seventh year (- 0.1795%) , in order to continue this negative impact and be more severe in the ninth (- 0.0326%) and the tenth year after the shock (- 0.0291%). Thus, the positive impact of public spending in Algeria remains limited on the growth rate (GDP), remains low compared to the negative impact, which confirms that public spending in Algeria remains limited, or even absent, for an increase growth rate of GDP. This would indicate that public spending leads to a particular crowding out of private activity, a result consistent with the results of comparable SVAR studies using the Blanchard-Perotti identification.

According to the estimates of the 10 year batch response functions described in Figure n ° 1, a single positive structural shock from ordinary taxation TAX estimated at 1% will have a significant but very small positive effect on GDP in the short term until second year after the shock (+ 0.04145%), in the medium term, a significant negative effect will be generated from the fifth year after the shock (- 0.0103%) will soon result in a smaller negative impact from the seventh year (- 0.0042%); in order to continue this negative impact and

be lower in the ninth (- 0.0016%) and the tenth year after the shock (- 0.0012%). The overall effect remains negative due to the complexity of the Algerian tax system. Despite the known reforms of the Algerian tax system and the increase in the tax pressure. This does not significantly boost the growth rate in Algeria in all economic sectors compared to the business environment of neighboring countries like Tunisia and Morocco.

4.2- Variance decomposition Results

From the results of the variance decomposition that during the first period, GDP is affected 100% by itself and that there is no effect of other variables on it, and at the fifth period, the variable is affected by 95.25% and the most influential variables on GDP are public spending G by 2.75% and the least influential are taxes, TAX of 1.76%, and the tenth period, the variable is affected by itself by 93.20%, and the effect of the explained variables represented by public spending increased by 5% and taxes by 1.78% on the GDP by comparing with the fifth period. Table n °5.

CONCLUSION

All the studies related to this subject, which retained the case of Algeria, unanimously recognized that there was a small positive effect of public spending in Algeria on economic growth, because these studies adopted all public revenues, fiscal and non-fiscal, ordinary and petroleum in the analysis, and the negative impact of taxes. As for this study, we only used ordinary taxation as a framework for determining state revenues, in order to avoid the impact of oil taxation and its specificity on the Algerian economy. The income elasticity represented in ordinary taxation (direct and indirect taxes) is very low (we found 0.48). The study also concluded that there is a positive effect of public spending on the rate of economic growth in Algeria, but it is smaller, and it is only in the short term and then turns into a negative impact in the medium and long term. Hence, the first hypothesis has been relatively true (in the short term only). This indicates that ordinary taxation is very limited to increase economic growth in Algeria with the strong presence of petroleum taxation.

When a negative shock occurs in the price of a barrel then the effect is transferred directly to the public revenues and automatically public spending. Therefore, the second hypothesis has been verified.

As a direct reflex, the authorities begin the process of finding alternative resources to cover this deficit for bear this shock in the medium and long term. This explains the use of shock absorbers such as the Income Adjustment Fund, foreign exchange reserves, pressure on spending or raising taxes, and in addition unconventional financing. These solutions are only short-term buffers, in the sense of finding temporary financial solutions, when the problem is much deeper.

It is a structural problem more than a financial one, this was clearly reflected in the state of the Algerian economy, and the characteristics of this influence were manifested in the adoption of an expansionary fiscal policy based on the increase in public spending and the growing role of the State in the economy through very significant public investments. Within the framework of economic stimulus programs and a revenue control fund was created and increased the level of hard currency reserves of Algeria reached a very high level and comfortable. Also Algeria has already paid its debts. All these measures had a preventive character in anticipation of a possible shock, rather than measures affecting the structure of the Algerian economy and diversifying it.

As we mentioned, there was significant public spending, but its economic efficiency was relatively low on economic growth levels, and there was no clear economic plan to resuscitate other economic sectors, especially the most vital, despite some attempts which have not had the necessary and necessary effectiveness. It is necessary to find an economic solution based on the development of the economic base and the widening of the tax base, and the diversification of the sources of income, that could motivate the fiscal policy and activate its tools in the Algerian economy.

We could have future studies by expanding the circle of countries as case studies and expanding the circle of data where possible. We can also detail public spending and public revenue in order to explore in detail the impact of shocks for each of these categories. Finally, we

can examine the role of public sector efficiency and policy volatility in the relationship between fiscal policy and growth. All of this will shape the future prospects of our research.

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