The relationship between fiscal deficits and the nominal exchange rate following negative external shocks. Evidence from Algeria

العلاقة بين العجز المالي و سعر الصرف الاسمي بعد الأزمات السلبية الخارجية. أدلة من الجزائر

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Received: 06-09-2020 *Accepted:* 09-03-2021

Abstract:

The paper empirically explores the relationship between the nominal exchange rate "USD/DZD" and two variables such as "Foreign exchange reserves and the budget balance" in Algeria, using a VAR modelisation on annual time series data for the period of 1967 to 2017. The empirical findings show that there is a significant negative short-run relationship between the exchange rate and respectively budget balance and the level of exchange reserves. Even if the exchange rate is determinated by the bank of Algeria, our study advances the fact, that it could have budgetary causes.

Keywords: *Budget deficit, devaluation, nominal exchange rate*
Jel Classification Codes : *E40, F31, H60.*

ملخص:

تهدف الدراسة إلى تحليل العلاقة بين سعر الصرف للدينار مقارنة بالدولار الأمريكي و احتياطات النقد من جهة و رصيد الميزانية من جهة أخرى. من أجل ذلك، تم استعمال نموذج VAR على بيانان السلاسل الزمنية للفترة الممتدة من 1967 إلى 2017. تبين نتائج الدراسة وجود علاقة سلبية قصيرة المدى بين سعر الصرف و رصيد الميزانية بتأخر مقدر بسنة و مستوى احتياطات الصرف. رغم أن سعر الصرف يتم تحديده من طرف بنك الجزائر، تبين الدراسة إمكانية ارتباط سعر الصرف للدينار مقابل الدولار بعجز الميزانية.

كلمات مفتاحية:عجز الموازنة، تخفيض قيمة العملة، سعر الصرف
تصنيف JEL: *E40, F31, H60*

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1. *INTRODUCTION*

In a conventional economics, the exchange rate is only one price among others that must reflect the relative scarcity of foreign currency. The real exchange rate supports export activities and encourages residents abroad to repatriate their savings through formal channels (Mernache, 2018). In Algeria, it must be noted that this rate, is weakly exploited as a lever to strengthening the productivity and competitiveness of the economy. For some, it is even used as a regulatory instrument for fiscal policy. In this context, the Bank of Algeria (BA) that "in the face of the large and lasting external shock, the exchange rate of the dinar has played, to a large extent, its role as a shock absorber, in the absence of fiscal consolidation" (Bank of Ageria, 2019, p. 3).

In order to maintain public expenditure at a high level, the BA depreciated the algerian dinar (DZD) against the united states dollar (USD) by about 19.8% between 2014 and 2015 (Bank of Ageria, 2019). This instrumentalisation is not a new phenomenon. During the 1980s, in order to manage the consequences of the 1986 oil shock, the Bank of Algeria adopted an active exchange rate policy between 1986 and 1988. During this period, and even before, the DZD's value was determined independently of economic considerations, i.e. by the central authorities (Achouche & Kherbachi, 2006; Begga & Merghit, 2012).

Indeed, in both theory and practice, competitive devaluations should enable economies to redress current account imbalances in line with Marshel-Lerner's conditions on foreign trade elasticities. This is not at all observable in the case of economies affected by Dutch disease such as that of Algeria. Nominal devaluations do not seem to be working as expected due to structural breaks in the transmission channels to the real economic sphere. Under these conditions, without taking ad-hoc measures with regard to productive export activity, an inflationary differential sets in. As a result, this only generates the price effect, which further aggravates the current account in the short term, but not the volume effect in the long term.

In this article, we will try to answer the question of whether the international economic situation actually affects the budgetary performance of the Algerian economy. If so, has the DZD exchange rate against the US dollar been changed for budgetary purposes? We put forward two hypotheses to try to provide an answer to our problematic. The first hypothesis "H1" supposes that the international economic situation affects the Algerian budgetary balance via exports. Indeed, if international demand for energy is decreasing, Algeria exports less hydrocarbons, which negatively affects the revenue regulation fund account and the level of oil taxes collected.

The second "H2" hypothesis assumes that the exchange rate increases each time export earnings fall. This will have the effect of increasing the level of the FRR, initially denominated in dollars, in domestic currency.

In response, we have structured the article as follows. First, we will examine the causal link between the exchange rate and the budget deficit through a selective review of the literature on the subject. Then, we will present a quick historical overview of the evolution of the exchange rate in Algeria. Finally, after having detailed the methodological framework of the study, we will discuss the main results of econometric estimation using a two-equation system analyzed by the VAR approach.

2. Literature review on the "exchange rate/fiscal deficit" linkage

This first part will be devoted to the analysis of the theoretical underpinnings underlying our research objective. It will be divided into two parts. In the first section, we will highlight the links between fiscal deficits and the exchange rate in a conventional economy and in a floating exchange rate regime. In the second section, we return to the analysis of these linkages in the context of a rentier economy with a fixed exchange rate regime.

2.1. Exchange rate and fiscal deficit: conventional links

In accordance with the teachings of standard economic theory, the direction of causality can range from fiscal deficit to exchange rate. In this case, the exchange rate evolution is only the consequence of the economic situation in which the fiscal deficit plays a predominant role. The economy in question is by definition a diversified, industrialized and export-oriented economy with high capital mobility and a floating exchange rate. Under these conditions, changes in a number of parameters, which are in turn affected by the management of fiscal deficit, directly affect the exchange rate. Overall, the situation is initially reflected in higher interest rates. This should attract more foreign capital as domestic investment becomes more attractive than foreign investment (Obstfeld and Rogoff, 1995;Ferrara, Metelli, Natoli, and Siena, 2020; Auerbach and Gorodnichenko, 2015;Miyamoto, Nguyen, and Sheremirov, 2019)Consequently, this implies a direct and/or indirect impact on the exchange rate.

In order to test the significance of changes in fiscal deficit on exchange rates, Beck (1994), studied five industrialized countries: The United States, Germany, Japan, the United Kingdom and Canada. He considers, in the context of financialized and open economies, that capital is quite mobile and that this mobility makes it possible to maintain interest rate parity. With full capital mobility, financial market participants will expect higher interest rates to attract capital inflows. In this case, the value of the domestic currency immediately rises thus, Interest rates

do not fluctuate, and the effect of the fiscal deficit is instead reflected in falling exchange rates.

Focusing on Pakistan, Burney and Akjitar (1992), find that real exchange rates are indirectly affected by fiscal deficits. The authors argue that although the overall government deficit is unrelated to the nominal interest rate, deficits financed by borrowing from the banking system are associated with higher nominal interest rates and thus contribute to exchange rate appreciation.

Feldstein (1986) explains the appreciation of the exchange rate, in the case of the United States, by the increase in federal fiscal deficit , which led to the appreciation of long-term real interest rates and, as a result, greater attractiveness of capital. For this, two major explanations have been put forward. The first is related to the peculiarity of the US dollar as an international currency. Any country issuing an international currency must accept trade deficits in order to make its currency available to international economic operators to enable international transactions denominated in that currency. The second is that government spending has a positive impact on the marginal utility of the consumption of non-traded domestic goods by reducing the consumption of imported goods. Domestic goods in the non-traded sector are in strong demand, which could generate an increase in their prices but without changing the price level of imported goods. As a reaction, the partner countries, in order to regain their competitiveness, most often resort to currency depreciation. However, when deficits increase in a context of unchanged fiscal expenditure, the marginal utility effect of non-traded goods is not generated and the deficit does not cause the exchange rate to appreciate. Bahmani-Oskooee and Payesteh (1993), examining the long-run relationship between U.S. federal fiscal deficits and the value of the dollar using cointegration analysis, show a two-way relationship between fiscal deficit and the effective exchange rate of the dollar.

Van Wijnbergen (1987) attempted to show, on the basis of a simple open economy model in which consumers base their inter-temporal spending plans and the demands of the asset market on rational behavioral optimization, how, under floating exchange rates, external shocks or internal structural reforms can cause inflation and exchange rate jumps through their impact on the state budget. The study concludes that if an exchange rate freeze collapses, inflation after the collapse will exceed the rate prevailing before the freeze

Vuyyuri and Seshaiah (2004), relying on Indian annual data for the period 1970-2002, used the cointegration and error-correction vector model approach. Their results reveal the existence of a two-way causality between the fiscal deficits and the nominal effective

exchange rate. They argue, in line with the teachings of the fiscal theory of the general price level, that fiscal deficits affect aggregate demand, which could lead to a rise in prices which may, in turn, lead to a loss in the value of the domestic currency. The findings of Yuli and San Tien-Ming (2003) and Mankiw (2002), studying the same phenomenon, showed that macroeconomic variables such as budget deficits, money supply, the exchange rate and the consumer price index influence each other. They suggest this will reduce demand for foreign exchange since domestic investment seems to be not only more profitable than FDI but it will also attract FDI into the domestic economy, which is likely to affect the exchange rate.

2.2. Exchange rates and fiscal connotations: rentier state case

Unlike in the case of conventional economies, in some non-conventional economies, such as rentier countries, the exchange rate is no longer seen as a consequence but rather as an adjustment instrument for fiscal policy. Indeed, when exchange rate regimes are fixed, capital is less mobile and economic activity is less diversified and less competitive, the implication of fiscal deficits in exchange rate movements can be direct. In this case, we would speak more of devaluation rather than depreciation. Exchange rate appreciation would be an adjustment policy used for budgetary purposes after each negative economic shock.

At first glance, it is important to note that the literature linking the exchange rate to fiscal performance is not overly abundant compared to the literature linking a causality of fiscal deficits to the exchange rate.

Kim and Roubini's (2008) paper empirically studies the effects of government budget deficit shocks on the accounts and the real exchange rate, during the period of the flexible exchange rate regime in the United States. Using a VAR model, they concluded that an expansionary fiscal policy shock, or a fiscal deficit, improves the current account and depreciates the real exchange rate. The authors explain this by the depreciation of the nominal exchange rate following the improvement in internal savings and production, in particular, allocated to exports.

In addition, in an IMF working paper, Chatterjee and Mursagulov (2012) discussed the effect of government spending on the real exchange rate. By extrapolation, if public expenditure is financed by deficits, their results concluded that this impact would depend essentially on four parameters in this case: the composition of public expenditure itself, the underlying policy of its financing, the intensity of private capital in production, and finally, the relative productivity of public enterprises. However, budget deficits can have several consequences on the development of the exchange rate depending on the parameters mentioned.

The analysis of Easterly, Rodriguez and Schmidt-Hebbel (1993), for the case of Zimbabwe for the period between 1987 and 1989, shows on the one hand that the devaluation of the domestic currency worsens budget deficits by increasing interest rates international loans on the country's loans and the import bill of companies and public administrations. However, the authors put forward the idea that devaluations increase the profits of exporting companies whose raw material is local. This improves public finances by improving the tax. In addition, exports attract currencies and help revalue the exchange rate with major currencies.

Saysombath and Kyophilavong (2013) highlight the difficulty of measuring the effect of fiscal deficits on exchange rate fluctuations. They studied this causality for the case of Laos, whose economy is heavily dependent on natural resources and which is heavily affected by Dutch Disease. Using ARDL and SVAR modeling, they found no relationship between the exchange rate and fiscal deficits.

The DZD evolution literature raises the multi-varied nature of its determinants. Some studies admit that the exchange rate management of the DZD is completely uncorrelated to macroeconomic parameters but without daring to objectively specify the purpose of this approach. Bouri and Badraoui (2019), examining this issue, pointed out that the management of the DZD value during the period 1967-1990 was completely uncorrelated with the performance of the Algerian economy. Progressive reductions in the value of the DZD during this period were made in order to counter the negative effects of the economic crisis resulting from the fall in oil prices in 1986. In their study, they found that government spending does not affect the real exchange rate, but the relationship between fiscal deficits and the exchange rate was not analysed. Begga and Merghit (2012)assert, but do not discuss, that the exchange rate was used as one of the main instruments of central planning and management. For Achouche and Kherbachi (2006, p.137), they consider that *"... during this period, the price of the Dinar was determined independently of all economic considerations, i.e. administratively and even politically, and parities were maintained relatively stable throughout this period despite and against all odds and in an arbitrary manner"*.

Lebsaira (2017), focusing on the DZD depreciation causes, seemed more explicit on this issue. Among a number of causes, she placed the worsening of budget deficits in the forefront. Indeed, the study highlights the close relationship between the DZD exchange rate, hydrocarbon export revenues, oil prices and fiscal deficits. However, the explanation of the mechanisms and direct and/or indirect interactions through which fiscal deficits influence the exchange rate is not sufficiently detailed.

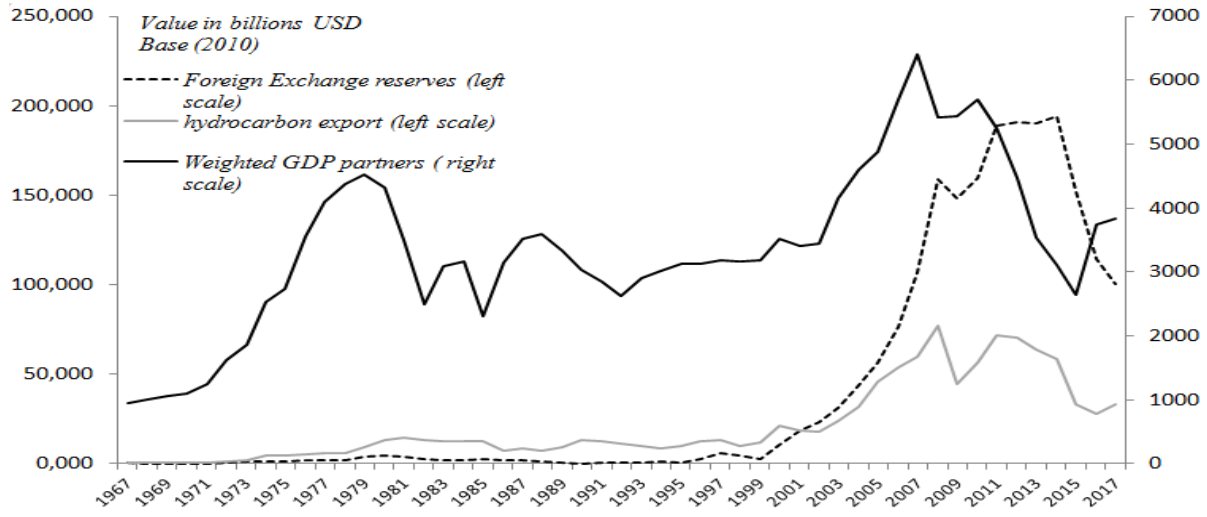
Zidelkhil and Mouhoubi (2020a) analyse the implication of the exchange rate to finance the budget as an implicit policy, and its links with inflation are twofold, in this case through the monetization of foreign assets "by increasing bank liquidity in domestic currency" and through prices relating to imports "by increasing the prices of imported inputs and finished products.

Refafa, Benbayer and Adouka (2017), for their part, highlighted the difficulty of anticipating exchange rates because their evolution would depend on several economic and political parameters such as the balance of payments, inflation, foreign exchange reserves, interest rates and capital movements. However, the authors did not highlight the implication of these parameters in the DZD exchange rate fluctuations particularly that of foreign exchange reserves, which is an important source of fiscal balance alongside external solvency. Kerzabi & Kerzabi (2017) refer this measure devaluation to a decision that falls under the injunction of political power in an attempt to curb the perverse effects of wage increases and their impact on public spending and the budget deficit. Moreover, the application of this measure is oriented towards making the exchange rate a shock absorber following the fall in oil prices.

3. Evolution of the exchange rates and the fiscal deficits in Algeria

In this section we will briefly present the main steps in the evolution of the USD/DZD exchange rate. The latter, as shown in Figures (1) and (2), has not stopped rising with the increase in fiscal deficits pronounced after each external economic shock. In this sense, it will not take into account the inflationary aspect of this development but rather the impact of negative shocks to budget balances on the change in the DZD/USD parity.

Fig.1. Evolution of foreign exchange reserves in Algeria, with regard to its hydro-carbon exports and the growth of its partner countries for export



Source: realised by the authors from ONS, Bank of Algeria and World Bank data

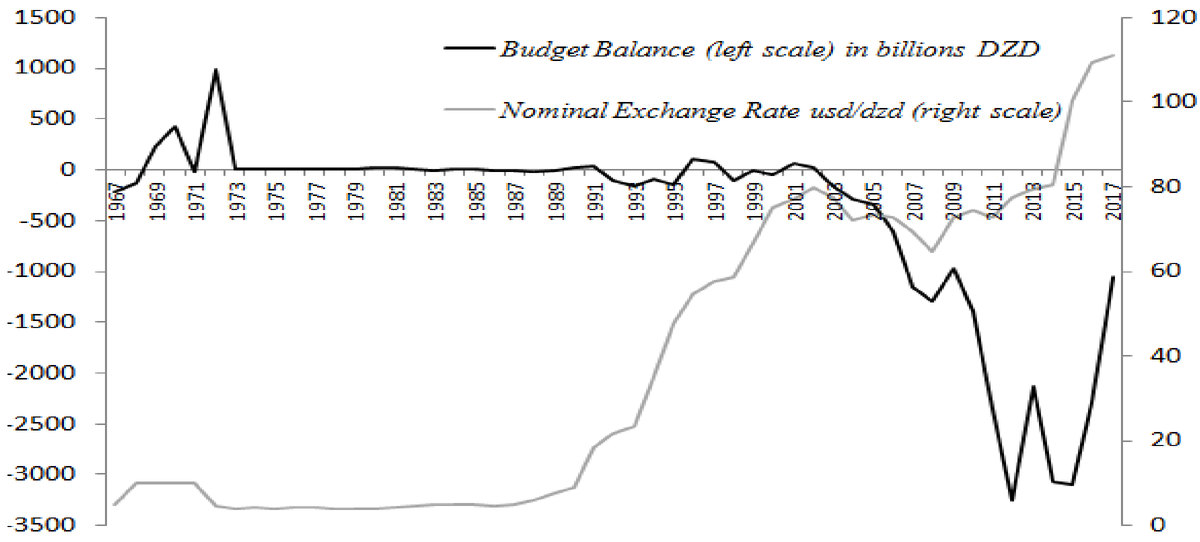
As shown in the figure (1), the significant constitution of foreign exchange reserves resulting from the increase in oil prices on the international market played a predominant role (143.1 billion USD in 2008 up from 17.1 billion in 2001). As a direct consequence of the global economic crisis in 2008, the price of a barrel on the international market fell by 37.7% in 2009. The exchange rate, even though it remained close to the equilibrium level, depreciated against the USD by 11.1% on average in 2009 and by 2.1% per year over the period 2010-2013 (Bank of Algeria, 2019).

Overall, the analysis of the graphs allowed us to deduce that the nominal exchange rate "USD/DZD" has evolved over three major stages. The first extends from 1970 to 1986. It corresponded to the period during which the DZD experienced considerable and permanent official overvaluation. It is characterized by four major facts: (1) fixed domestic prices; (2) steadily rising external prices, particularly in USD; (3) the multiplicity of official exchange rates; and 4) development of a parallel currency market. Throughout this period, the DZD had an average value of 4.63 units for one USD. The second phase covers the period 1986-1998, during which the Algerian economy suffered from negatives consequences of the 1986 oil counter-shock. It was characterised by three major facts: the size of the fiscal deficits, the official DZD devaluation and the adoption of the managed float regime from 1993. The period corresponds to the phase of drastic DZD nominal devaluation. The latter went from 6.73 units of the DZD for one USD in 1988 to 17.8 units in 1991 and 60.6 units in 1998 (i.e. an annual depreciation rate of 8.06%). The average exchange rate was 24.84 units to the US dollar from 4.63 units during the period 1970 to1986.

For the period from 2000 to 2018, the real exchange rate is stabilized in relation to the good performance of macroeconomic fundamentals, notably the level of public expenditure, the oil prices of and the differential in the level of inflation with the main partner countries. However, some hesitation was recorded following the various external shocks that affected the Algerian economy during this period. Over the period 2000 to 2008, the DZD followed a significant trend of appreciation and stabilization. It rose from 79.7 DZD units for one USD on average in 2002 to 64.6 units on average in 2008, with an appreciation of 23.4% (Bank of Algeria, 2019).

The visual analysis of figure (2) highlights a negative correlation between the budgetary balance and the USD / DZD exchange rate, since the 90s. Note that the budget deficits have worsened since 2003 passing from 164.624 to 1050.031 billion dinars in 2017. These deficits are not due exclusively to the contraction of revenues but also to the excess of expenditure (DGT, 2011).

Fig. 2. Evolution of the nominal exchange rate and the budget balance in Algeria



Source realised by the authors from National Statistics Office and Bank of Algeria's data

The oil shock of 2014 has come to complicate the situation due to the sharp deterioration in economic fundamentals. Since then, fiscal deficits have continued to increase and the reserves built up under the revenue regulation fund have been completely exhausted. In foreign exchange terms, the value of the DZD/USD depreciated by about 19.8% between 2014 and 2015. Although slight appreciation/depreciation has been noted, this value will remain stable from 2016 onwards.

4. Model specification

In this part of our study, as a first step, we will designate the appropriate model, explain how the variables are constructed and describe the sources of our data. As a second step, we will explain the econometric methodology for the estimation and the interpretation of the results.

4.1. Estimation methodology

The only variable we calculated is that of the weighted GDP of the partner countries. We used the weighted average technique of which the annual weighting coefficients are calculated in relation to the 22 main trading partner countries2 representing, on average over the period studied, 86% of global trade with weights which change from one year to another. The observations of the « Igdpt » series will be constructed using the weighted average method used by Zidelkhil and Mouhoubi (2020b) as follows:

$$Igdp_t = \frac{\sum_{t=51}^{n=22}(x_{1t}, x_{2t}, x_{3t}, \dots\dots\dots\dots, x_{nt},)}{\delta_{nt}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (1.1)$$

[2] The countries concerned are: Italy, France, USA, Netherlands, Spain, Belgium, Germany, G. Brittany, Brazil, Austria, Turkey, Canada, Portugal, India, Tunisia, Morocco, China, Russia, Poland, Switzerland, Argentina and Japan.

Where: $x_{nt} = \alpha_{nt}\emptyset_{nt}$ and $\delta_{nt} = (\alpha_{1t} + \alpha_{2t} + \cdots \ldots \ldots + \alpha_{nt})$

$$Igdp_t = \sum_{i=1}^{22} \alpha_{1t}\emptyset_{1t} + \alpha_{2t}\emptyset_t + \ldots \ldots . \alpha_{22t}\emptyset_t \ldots \Big/ (\alpha_{1t} + \alpha_{2t} + \cdots + \alpha_{22t}) \ldots \ldots \ldots . \ldots (1.2)$$

Such as:

$\emptyset_{nt}$ = the real GDP base 2010 from each partner country « n » at « t » periode.

n = 22: is the number of Algeria's partner countries for export (client countries) which constitute nearly 86 of total Algerian exports.

$\delta_t = (\alpha_1 + \alpha_2 + \cdots + \alpha_{22})$: is the sum of the weights

t = the number of years that make up the chronological series from 1976 to 2018.

The terms of the equations investigated in this study are aggregated as follows:

$$Xnr_t = b_0 + b_1 Bgb_t + b_2 Fer_t + \mu_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (2)$$

$$Fer_t = a_0 + a_1 Hexp_t + a_2 Igdp_t + \xi_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (3)$$

Where

- Fer_t= Foreign exchange Reserves[3] in US nominal value(Data from Bank of Algeria reports). The use of foreign exchange reserves as an explanatory variable aims to establish a relation with the level of Algerian hydrocarbon exports with, on the one hand, the level of growth of the partner countries and, on the other hand, with the possible monetization for fill the government budget. If the relation is negative with the exchange rate, we deduce that when it decreases the government increases the exchange rate.
- Exnrt = Nominal Exchange Rate (Usd/Dzd)(Data from Bank of Algeria and Algerian National Office of Statistics). The exchange rate variable is the variable to be explained.
- Igdpt = GDP of client Partner countries (weighted average)(Calculated from World Bank data). « Real value base 2010 ». To calculate this variable we first took the countries to which we export more than 80% which are of the order of 22 countries. After having calculated the weighting coefficients according to the above-mentioned method, we calculated a weighted GDP. If the sign between the GDP and the

[3] If we had taken the foreign exchange reserves in dinars, the link between them and the exchange rate becomes obvious and we will not have to demonstrate it. However, FRt is labeled in dollars to avoid the evidence of corollary, so if it goes down, it will mean that the exchange rate will be used to increase their equivalent in domestic currency to finance the economy and the government budget.

exchange rate is negative, it will mean that when the GDP drops "negative external shock" the exchange rate increases.

- Bgbt = Domestic Budget Balance in nominal value, domestic currency (Data from Algerian National Office of Statistics).The sign between the budget balance and the exchange rate must be negative. When the budget balance is negative or falling the exchange rate increases. Likewise, when the foreign GDP falls, the fiscal balance becomes negative in the long run
- Exp_t= Hydrocarbon export. In US nominal value(Data from Algerian National Office of Statistics and Bank of Algeria reports. exports of hydrocarbons constitute foreign exchange reserves and increase oil taxation. the expected sign between these exports and the budget balance is positive. however, it is negative with the exchange rate

Nb: This model does not take into account the differential parity between the dollars and the euro.

4.2. Unit root test

Many macroeconomic variables are usually non-stationary for this purpose we can apply unit root testing technique in order to see whether the variables are stationary or not. The first step, in the analysis, is to test the stationarity of variables. We use Augmented Dickey-Fuller Test (ADF) in order to examine it. The results of the stationarity tests are summarized in table (1) below.

Table 1. The stationarity results and the optimal Lag

			Model 3		***Model 2***		***Model 1***	
	Variables	Lag	ADF	Tc	ADF	Tc	ADF	Tc	
Equation (1)	*Resid_Exnrt*	2	-2,66	-3,50	-2,52	-2,92	-2,57	-1,94	I(0)*
Aic Criterion =5,8170	*Resid_Bgb$_t$*	9	-4,31	-3,52	-3,57	-2,92	-3,47	-1,94	I(0)*
SC Criterion = 6,0926	*Fert*	10	6,64	-3,523	4,46	-2,93	-2,21	-1,94	I(2)***
*Optimal Lag VAR= **2***									
Equation (2)	*Hexpt*	1	-2,06	-3,504	-1,39	-2,92	-7,10	-1,94	I(1)**
Aic Criterion= 13,386	*Igdpt*	2	-1,87	-3,50	-2,10	-2,921	-5,38	-1,94	I(1)**
SC Criterion = 13,662									
*Optimal Lag VAR= **2***									

Note: * rejection of the null hypothesis, the series is stationary at level.

** Stationary at first difference

*** Stationary at second difference

Source: Calculated by the authors from ONS and Bank of Algeria's data using Eviews 7

The stationarity tests summarized in table (1) indicates the following results: The statistic of the trend for the variables *"Exnrt"* and *"Bgbt*" are respectively significantly different from 0. These two series have a trend that we had removed. Thus our model will use the series of the residues of these two variables which is stationary at level.

The "*Fert"* series is stationary at the second difference with an ADF statistic "-2.21" lower than the calculated statistic "-1.94". The series: "*Hexpt*" and "*Igdpt"* series, they are stationary with a single filter "first difference". Regarding the choice of optimal lag length, basically two criteria are used namely the AIC and the SC. The Akaike and Schwarz criterions indicate an optimal delay of 2 periods.

4.3. VAR Estimation

A/ Equation of the model 1

The estimated parameters of model 1 are written as follows:

$Resid\_Exnr_t = -0.9061+1.2274\ Resid\_Exnr_{t-1} -0.3315\ Resid\_Exnr_{t-2} –$

$[-0.7983]\ [-2.1789]$

$1.76^E\text{-}06\ Resid\_Bgb_{t-1} –3.58^E\text{-}06\ Resid\_Bgb_{t-2} -0.0022\ Fer_{t-3}$ -

$[7.7769][1.8415]\quad [-1.5742]$

$0.0028\ Fer_{t-4}$………………………………………………………………..(2.1)

$[1.7284]$

B/ Equation of the model 2

The estimated parameters of model 2 are written as follows:

$Fer_{t-2} = -16.94287 + 1.4504\ Fer_{t-3} - 0.4869\ Fer_{t-4} + 52.1762\ Hexp_{t-2} + 31.58\ Hexp_{t-3}$

$[11.9090] \quad [-4.47162] \quad [12.9387] \quad [-4.2345]$

$+ 0.0604\ Igdp_{t-2} + 0.1162\ Igdp_{t-3}$ ……………………………... (3.1)

$[0.9848] \quad [-1.6991]$

According to these model 1, the coefficients with *T* value show that only $Resid\_Bgb_{t-1}$, $Resid\_Bgb_{t-2}$, and Fer_{t-4}, reflects insignificant relationships at 5and 10 percent level of significance. The coefficients of $Resid\_Bgb_{t-1}$ and $Resid\_Bgb_{t-2}$ Carries a negative sign that means if budget balance decreases, the exchange rate increases at the same time. Besides, they are statistically significant respectively at 5 and 10 percent level of significance. Regarding the variable Fer_{t-4}, this is significant at the 10% threshold with 4 delay times. The sign of the correlation is negative. However, with 4 delay times, the exchange rate increases when the foreign exchange reserves decrease.

For model 2, it indicates the significance of the variables $Hexp_{t-2}$ and $Hexp_{t-3}$, since the absolute values of the Tc are greater than 1.96. However, the "Igdp" variable is not significant

with a delay time since the calculated t value is less than 1.96. But with two delays, it is significant at the 10% threshold.

Similarly, the correlation signs are positive, this attests to, the positive effect of the partner's countries growth and of hydrocarbon export volumes at the level of Algerian foreign exchange reserves.

4.4. Granger Causality Test

According to Granger causality, we want to verify the probable causal links between the respective variables of the two models as well as the nature of the causality, whether unidirectional or bidirectional. The results are listed in Table (2) below:

Table 2. Granger Causality Test for the tow models

Null Hypothesis			Prob
Fert -2	does not Granger cause	$Resid\_Bgb_t$	0.0039*
$Resid\_Bgb_t$	does not Granger cause	*Fert-2*	0.0087*
Hexpt-1	does not Granger cause	*Fert-2*	2^E-17*
Igdpt-1	does not Granger cause	*Hexpt-1*	3^E-05*
Igdpt-1	does not Granger cause	*Fert-2*	0.0034*

*Note:** rejection of the null hypothesis of the absence of a causal relationship

Source: Calculated by the authors from ONS and Bank of Algeria's data using Eviews 7

The results of the Granger test for the two models are as follows:

We have a two-way causality between the "Fert -2" foreign exchange reserves and the "Resid_Bgbt" budget balance and this can be explained by the fact that the foreign exchange reserves which are generally used to stabilize the balance of payments, can also be used to balance the budget by monetizing them in national currency.

This being true insofar as the receipts resulting from the petroleum taxation which in turn depends on the export of hydrocarbons are recorded in the revenue regulation fund which is a source of financing of the State budget. When Algeria faces a negative external shock, these revenues fall. This may encourage the authorities to monetize them with larger exchange rate "devaluation" hence the budgetary implication of exchange rate fluctuations.

As for the influence of the growth of partner countries "Igdpt-1" as well as the nominal volume of exports of hydrocarbons "Hexpt-1", on the volume of Algerian foreign exchange reserves, the latter is proven. This can be explained by the energy consumption of these countries and their links with the growing import of hydrocarbons from Algeria. This consumption increases the volume of our exports in the long term and generates significant income, which increases Algerian foreign exchange reserves. The short-term causality between the exchange rate and foreign exchange reserves as well as the budget balance has not been proven by the Granger test.

4.5. Impulse response function

In this section, we will present the different results of the VAR model specified in the previous parts. We are mainly interested in the shock response functions. This instrument makes it possible to synthesize most of the information contained in the dynamics of the estimated VAR system. In addition, it highlights the nature of the effects of different shocks on the variables. So, it therefore seems interesting to us to examine the impact of exchange rate shocks on the budgetary balance and on the level of foreign exchange reserves on the one hand and to analyze the export shock and the growth of partner countries in export on the level of foreign exchange reserves on the other hand. Figures (3), (4), (5) and (6) show the impulse response functions where the dashed curves representing the confidence interval. We consider that the amplitude of the shock is equal to twice the standard deviation and we are interested in the effects of the shock over 10 periods (i.e. 10 years). This horizon represents the time required for the variables to return to their long-term levels.

Fig.3

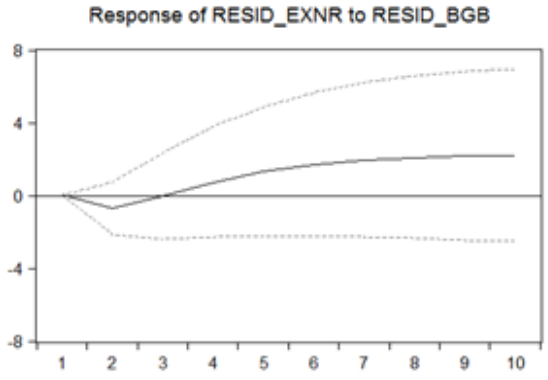


Fig.4

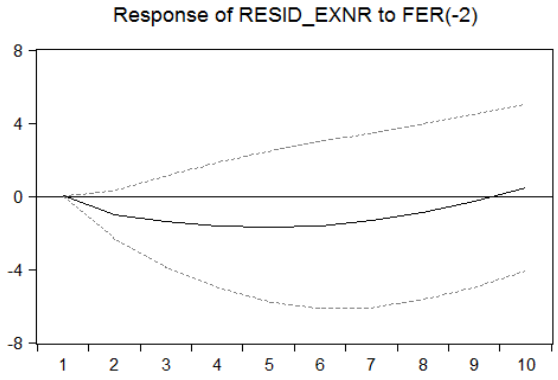


Fig.5

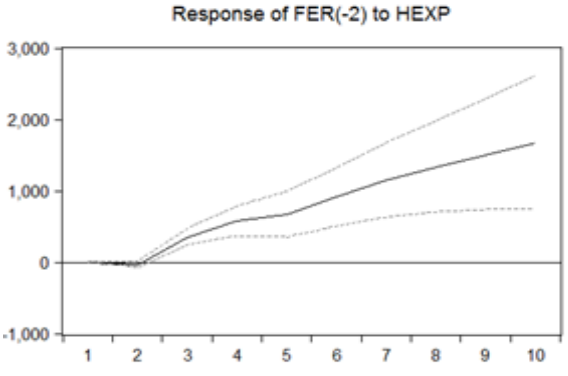
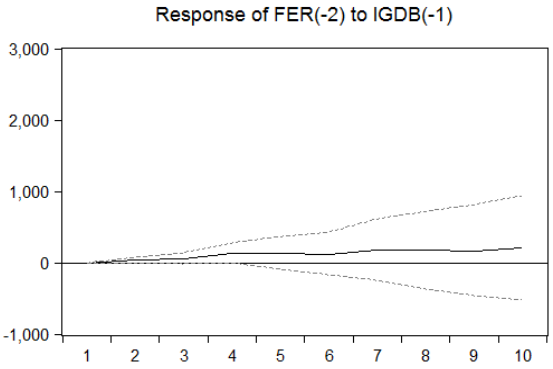


Fig.6



Source: Calculated by the authors from National Statistics Office and Bank of Algeria's data using Eviews 7

Figures (3) and (4) illustrate the impact of a shock to the budget balance and the level of foreign exchange reserves "with two delays" on the nominal exchange rate "USD / DZD" is not instantaneous.

According to the figure (3), the response of nominal exchange rate to the shock on budget balance begins from the middle of the first year with a negative response. This corroborates the results of causality and significance of the parameters since the exchange rate maintains a negative relationship with the level of the budgetary balance that can be explained as follow: when the budget balance represents negative values, it may be tense on certain financial instruments to make up the deficit. However, when the tension on these instruments becomes significant, the use of the exchange rate becomes an important palliative to play a damping role. in fact, by increasing the exchange rate, government revenues denominated in particular in dollars can be amplified once monitized and transformed into domestic currency in this case "the Algerian dinars".

Concerning the figure (4), there is a negative correlation between the exchange rate and the level of foreign exchange reserves delayed by two years. This can be explained by increases in the exchange rate when the level of foreign exchange reserves drops. This operation can be explained by the desire to increase their equivalence in domestic currency in order to balance the budget.

With regard to Figures (5) and (6), the positive shocks resulting from the variation in the volume of hydrocarbon exports and the level of growth in partner countries, generates positive variations in the level of Algerian foreign exchange reserves. The impact is not instantaneous and the effect of exports on reserves seems to be more important than that of international demand "partner countries" for energy. Indeed, Algerian foreign exchange reserves are almost exclusively made up of hydrocarbon export revenues up to just over 97% of total exports (Bank of Algeria, 2018).

5. *Conclusion*

First, the article empirically explores the existing relationship between the economic growth of Algeria's client countries in terms of hydrocarbons and the level of foreign exchange reserves as well as the budgetary balance. Second, it analyzes the relationship between the nominal "USD / DZD" exchange rate and two variables such as "foreign exchange reserves and fiscal balance" in Algeria using annual time series data for the period 1967 to 2017. The empirical results show that there is a significant negative long-term relationship between the exchange rate and respectively the fiscal balance and the level of foreign exchange reserves with an estimated delay of one and two years according to the results of model 1.

Our results are consistent with what the Bank of Algeria "Thus, faced with a large-scale and lasting external shock, the dinar exchange rate played, to a large extent, its role of shock absorber, in the absence of consolidation (Bank of Algeria, 2019, p.3). The study also shows the significant positive effect of hydrocarbon exports and international growth of trading partners on the level of Algeria's foreign exchange reserves Thus, the budget deficit is not only caused by budgetary expenditure on revenues but would also respond closely to the economic growth of Algeria's main client countries. Even if the exchange rate is determined by the Bank of Algeria, and that a certain increase in the exchange rate against the dollar results from the depreciation of the latter, our study advances the fact that the nominal exchange rate between the Algerian dinar and the dollar has budgetary implications and indirectly depends on the level of economic growth of the countries that are clients of Algeria through their energy consumption.

Following extensive research, we have found that the use of the budgetary approach to explain the exchange rate is little discussed whether for the case of Algeria or for international studies. The results advanced in this research may be a line of research for future studies that will want to further explore this approach. That said, the exchange rate is widely analyzed for the Algerian case and elsewhere but not by budgetary explanations. This explains the lack of referencing in this area.

This study allows us to put forward some recommendations which can be the subject of a response to our results. Firstly, since the dependence of foreign exchange reserves is important to the economic performance of partner countries, Algeria must diversify these to export materials other than hydrocarbons. Thus, it will be vulnerable to negative fluctuations in their energy consumption and growth. Second, since the transmission channel between exports and the level of the budget balance is oil taxation, Algeria must broaden its tax base to increase the level of ordinary taxation. This will have the effect of exerting less pressure on the exchange rate in the event of negative shocks Finally, to think about the convertibility of the dinar and the improvement of the quality of the capital mobility so that its value is dependent on fluctuations in the exchange markets and to attract foreign capital by way of palliative financing.

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