Fiscal Policy Response Measurement to the Shocks of the Rate of Trade Exchange in Algeria for the Period (1990/2018).

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Abstract:

Within the scope of Algeria's quest to consolidate its commercial relations with other countries of the world and directing its efforts and its economic policy towards increasing trade exchange and economic growth, this study aims to measure the response of the financial policy to the shocks of the rate of trade exchange in Algeria from 1990 to 2018, by using the variables rate of trade exchange, public revenues and public expenditures, by estimating the VAR model, conducting Granger causality test, the impulse response functions and analyzing variance decomposition. The study concluded that the occurrence of any random shock in the rate of trade exchange affects the fiscal policy, by affecting negatively and directly the public revenues starting from the second year, while the impact on public expenditures is positive, weak and fluctuating during the response period.

*Key Words***:** rate of trade, Fiscal Policy, Shocks, Public Revenues, Public Expenditures.

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Introduction:

In view of the great importance of foreign trade, all countries have strived to expand it and move towards economic union and integration by adopting trade policies that would increase economic openness, trade and international payments liberalization and productive specialization. As a result, it has become necessary to deal with caution with these transformations, by adopting an economic policy based on strong foundations to confront any shock that the national economy may be exposed to.

Various countries from all over the world face big and real commercial economic shocks, especially the ones of the rates of trade exchange, in addition to their great exposure to the prices of imports and exports of goods, such as the prices of primary resources. Oil is the most influential merchandise in causing shocks to the rates of trade exchange that oil countries are exposed to, whether they are exporting or importing ones, which makes countries with an undiversified economic structure, such as Algeria that mainly depends on oil revenues exposed to a state of instability in its policy due to oil prices fluctuations. That is, it remains vulnerable to sudden shocks in its trade rates.

Statement of the problem:

The oil sector plays an important role in the Algerian economy; as it relies on more than 90% of its income on petroleum resources and oil constitute most of its exports. It is an active member in OPEC, meaning that there is structural weakness resulting from dependence on one major commodity and this makes the national economy vulnerable to the price shock as changes in oil prices, whether it increases or decreases, has a strong effect on economic variables in Algeria, especially on its financial policy. Hence, the main study problem is summarized in the following question: **To what extent do trade exchange shocks affect the nature of the fiscal policy response in Algeria?**

Study Hypothesis:

The study is based in its tentative answer to the above problematic on the following hypothesis: The trade exchange rate shocks have an impact on the nature of the fiscal policy response in Algeria.

Study Objectives:

This study aims to:

- Analyzing the development of the rate of trade exchange in Algeria, and explaining its correlation with the various relevant economic and development indicators, in order to deduce the strengths and weaknesses of the Algerian economy's foreign trade.

- Detection of the mechanism and the extent of the fiscal policy response to shocks in the rate of trade exchange in Algeria.

Study significance:

The importance of the study rises from the economic importance represented by the rate of trade exchange, especially in the context of Algeria's constant strive to build foreign trade relations and to direct its efforts to increase trade exchange and economic growth, allowing the creation of a stable modern economy based on a strong financial policy with a balanced multi-resource financing base, characterized by a high degree of internal integration that guarantees the continuity and durability of economic growth.

Study limits:

The spatial limit of the study was limited to Algeria, while the temporal limit was chosen to be the period (1990/2018) due to the availability of data, in addition to the fact that the period witnessed a number of external trade shocks, which is appropriate for measuring and analyzing variables search.

Study Approach:

This study is based on a scientific research approach that combines the descriptive and quantitative methods, where the descriptive method is based on presenting concepts and describing the relation between the study variables and benefiting from previous studies, while the econometric quantitative approach is used to test the correlation between the rate of trade exchange and financial policy, based on time-series tests, shock analysis, and immediate response functions.

Previous studies:

We can mention some economic studies which focused on factors and variables of fiscal policy affecting or affected by shocks of trade exchange rate, including:

- The study of (**Razoug, 2017**) entitled: "The Impact of the International Trade Exchange System on Economic Development in Algeria, an analytical econometric study during the Period (1980-2014)", which is a research published in the Journal of Economic Studies, Volume IV, Issue Three, Faculty of Economic, Business and Management Sciences, University of Constantine 2. The study analyzed and measured the impact of international trade exchange system on economic development in Algeria during the period (1980-2014). In order to achieve this, the development of foreign trade statistics and a set of economic and development indicators were presented, and also modern econometric methods were used as Johansson's co-integration approach, the bounds testing approach, as well as Granger causality test, and this through three models that measure the impact of trade openness and foreign direct investment as independent variables on each of the per capita gross domestic product, the total number of employees and the added value in the agricultural sector as dependent variables. The results of the study indicated the positive impact on per capita growth rate, and the negative impact on both the number of employees and the agricultural sector.

- The study of (**Attai & Hussein, 2016**) entitled: "Analysis of the impact of trade exchange rate shock on the financial policy in Iraq for the period (1990/2012)," a research published in the Journal of Administration and Economics, Issue 107, Al-Mustansiriya University, Iraq. Where the study showed the effect of trade exchange rate shocks in in Iraq on the response of the financial policy, where the quantitative method was used based on the estimation of the variables used for the research sample, using time series tests, shocks analysis test and immediate response functions. The study reached a set of results, the most important of which were: Emphasizing that shocks in trade exchange rate in Iraq are related to two main factors, the political factor and the total dependence on the export of crude oil. In addition, the Iraqi economy has been exposed to three shocks in the rate of trade exchange, and the fiscal policy response to the three shocks was keeping up with the economic cycle, and the oil sector played the largest role in these responses as well as being the first and main cause of the shocks.

The study also recommended the need to diversify the Iraqi economy and its sources of income, as well as the necessity of separating the relationship between shocks in trade exchange rate and fluctuations in the oil sector, with an emphasis on developing a long-term strategy concerned with saving the surplus in times of high oil prices in order to benefit from it in times of deficit.

- The study of (**Saad, 2012**) entitled: "The evolution of trade exchange rate in Egypt in light of the application of trade agreements for economic integration and companies for the period (2000/2009)", which is a master's thesis in economics, Faculty of Economics and Political Science, Cairo University. The study discussed the development of trade exchange rate focusing on three trade agreements, the Arab Free Trade Area, the COMESA Agreement, and the Egyptian-European Partnership. The study also targeted trade exchange between Egypt and other countries as a vital economic activity, how to calculate the rate of trade exchange and its various types, shed light on some trade agreements and to what extent these

agreements contributed to the economic growth of Egypt. One of the most important results of this study was proving that the state's rate of trade exchange indicates its limit of import and export, and the absence of goods with a competitive advantage. Despite the importance of trade agreements and the existence of a mutual benefit between Egypt and other members, but there has been no improvement in the level of trade exchange in general.

I. Theoretical approach to trade exchange rate shocks:

Trade exchange or international trade can be defined as: "the exchange of goods, services and capital between countries" (Hassan, 2014, p. 26).Others define it as:" the exchange of material goods, services, capital, and the movement of people for tourism and work" (Abdel-Aal, 2012, p. 25), this means that international trade exchange is the movement of exports and imports and services, noting that commodities are not only material, but go beyond to be non-material represented in knowledge or intellectual capital, in addition to foreign investment flows, and travel of qualified labor to work between different countries.

Foreign trade is a fundamental indicator of the economy's productive capacity and competitiveness in the international market. Trade is based on exchanges between countries; however, the exchange process may witness trade shocks from time to time resulting from negative or positive changes in prices of the trade balance elements.

1. Definition of trade exchange rate:

The rate of trade exchange is defined as the relative price of the export price index to the import price index during a given period (Al-Dour & Mallawi, 2015, p. 196). The rate of international trade exchange for a country is also defined as the number of imported units that the country obtains for every exported unit abroad, but in practice the price of each commodity is expressed in a certain amount of money and not in units of another commodity (i.e. cash and not swap), thus the international exchange rate is determined by the comparison between the price of a country's exports and the price of its imports. (Bastali, 2013, pp. 4,5)

2. Methods of measuring trade exchange rate:

Due to the multiplicity of exported and imported goods, as well as the multiplicity of their prices and quantities, it is necessary to use a set of statistical methods to measure the rate of international trade exchange, the most important of which are: (Diab, 2010, pp. 141,145)

2.1. Rate of net trade exchange:

This rate is considered as one of the simplest and most widespread rates, it helps in the comparison between the export price indices and the import price indices as follows:

Net Trade Exchange Rate = Export Price Index / Import Price Index x 100

Indices are defined as relative numbers or summaries of several rational numbers. They are used as a tool to measure changes that occur in phenomena values composed of several factors (simultaneously) changing from time to time. (Al-Sous, 2007, p. 17)

A decrease in the exchange rate below 100 expresses its direction not in the interest of the state, while its increase from 100 expresses its direction in its interest, and this rate can often be used to indicate whether there is an increase or decrease in the

volume of goods that must be exported to obtain a certain amount of imported goods, it is a net rate because it is used for two quantities of goods whose value is assumed to be equal. If we assume that the value of imports is equal to the value of exports, that is: *Q1 x P1 = Q2 x P2*

Where: Q1: the quantity of imports, P1: the unit price of the imported good,   Q2: the quantity of exports, P2: the unit price of the exported good,

And then: *Q1 / Q2 = P2 / P1*

In fact, indices are calculated for exports or imports that are heterogeneous, and therefore they must be weighted, meaning that it is appropriate when calculating the price index, whether for exports or imports, to give each commodity a proportional weight with its importance. The use of the price index is due to the exclusion of the effect of change in prices,

One of the two methods can be used here for weighting: Either the use of the quantities of the base year or the so-called Laspeyres Index, as follows:

Index = Quantity in the base year x Price in the comparison year / Quantity in the base year x Price in the base year x 100

The second method is to use the quantities of the comparison year or the so-called Pash Index, and it is calculated according to the following formula:

Index = Quantity in the year of comparison x Price in the year of comparison / Quantity in the year of comparison x Price in the base year x 100

Fisher's method can also be used, which is the optimal index because it combines the two previous numbers. If the ratio between the export price index and the import price index is greater than 100, then we say that the net trade exchange rate is good, meaning that there is an improvement in the country trade; I.e. it sells abroad at a price higher than the one with which it buys, but if the ratio is less than 100, that means that there is a drop in the rates of trade exchange; meaning that the state buys from abroad at a higher price. If the ratio is 100, then that means there is no change.

2.2. Rate of total trade exchange:

Economists usually use the total exchange rate if the goal is to give a general idea of the actual imports of the state, whether it was financed by the state's outcome from current exports, or by borrowing from outside, but if the goal is to show actual imports that have been paid for by export earnings only, then they use the net0 exchange rate. This rate represents the ratio between the index of the volume of exports and the index of the volume of imports multiplied by 100, and it is calculated according to the following formula:

Total rate of trade exchange = index of volume of exports / index of volume of imports x 100

2.3 Income exchange rate:

It is the ratio between the value of exports and the price of imports, that is, it expresses the ratio between the index of export prices and the index of import prices multiplied by the index of the volume of exports, and this rate reflects the country's ability to import, so it is sometimes called import capacity as it is considered very important and necessary if it is required to study the effect of international trade on economic welfare. It is calculated as follows:

Income exchange rate = Export Price Index x Export Volume Index / Import Volume Index x 100

The rate of trade exchange can also be calculated by the ratio of the total indicators of commodity exports and imports and the trade exchange rates index is based on the prices of six commodity items (food, fuel, agricultural raw materials, minerals, gold, and drinks), and it is calculated as follows: (Al-Tai & Ali Hussein, 2016, p. 3)

$$ToT = IiI\ (Pi\ muv)^{Xij} / IiI\ (Pi\ muv)^{Mij}$$

Where: **i:** represents the six classes of commodities, X: is the share of exports of commodity i in the total trade of country j, and M: is the share of imports of commodity i in the total trade of country j.

The rate of trade exchange depends on the employment of local resources, production techniques, income and production distribution, consumption, and the import of goods. An increase in the statistical measure of trade exchange rate indicates an improvement in the rate or an improvement in trade conditions, while its decline indicates the drop of trade conditions. And that any improvement in the rate of trade exchange results in an increase in the welfare of society, and its decline leads to a decrease in the social welfare of the country. (Funke & others, 2008, p. 6.7)

3. The concept of trade exchange rate shocks:

Economies with different systems face many internal and external trade shocks from one period to another leaving clear effect in different sectors; this is due to the interlaced nature of economic variables, in addition to the existence of effective channels for economic ties between different countries.

3.1 Definition of trade exchange rate shocks:

A shock is defined as the event that creates sudden and different changes (most of the time unexpected) in the economy and various economic variables. The shock is either positive or negative; the positive one leads to an improvement in the value of the variable, while the negative shock leads to deterioration in the value of the economic variable, and this is called economic crises. (El-Sayed & Hussein, 2015, p. 1)

Concerning the economic shock, it means: "events from internal or external source that affect the economy, the internal shocks are divided into monetary and real shocks. As for the external ones, they take the path of economic cycles." (Al-Ghalibi A.-H. J.-H., 2011, pp. 118,119)

Trade exchange rate shocks can also be defined as sudden changes that occur in the rates of trade exchange of a country, whether those changes are on the side of import prices or on the side of export prices, and therefore these sudden changes may be negative (resulting from a sudden decrease in export prices, or an increase in import prices or both), or they may be positive (resulting from a sudden rise in export prices or a decrease in import prices, or both), and the shocks may be temporary due to government intervention by taking financial procedures that limit or work to stop these shocks, especially the negative ones, and they may be permanent shocks that government cannot handle it, so it will last for a long time. (Al-Tai & Ali Hussein, 2016, p.3)

Therefore, trade exchange shocks are sudden events that may be internal or external, cannot be controlled and have strong economic effects.

3.2 Types of shocks in the rate of trade exchange:

The types of shocks are determined based on their impact on global manufactured goods prices and global economic exchange activity, so it can be divided into three types, as follows: (El-Sayed & Hussein, 2015, p. 2)

- **Demand Shocks:** These are represented by changes in economic policy, such as fiscal policy shocks (government and private spending shocks and tax rates), monetary policy shocks (money supply and interest rate) and exchange rate policy, in addition to changes in private investment or consumer spending.

- **Supply Shocks**: Or productivity shock that directly affects the production side and represents the real side, such as technological progress (innovations, inventions), climate changes, conflict occurrence, the discovery of new energy sources, or the change of supply sources. One of the most important shocks occurring on the supply side is the rise in global prices of imported inputs such as primary and intermediate goods.

- **The globalization shock**: It is associated with the drop of manufactured goods prices, the rise in commodity prices and an increase in global economic activity (Jääskelä & Smith, 2011, p.1).

This shock has a particularly marked effect on developing countries due to the weakness of their economies, the high dependence on export commodities whose prices are more changeable than those of manufactured products and moreover, because developing countries in general have a high degree of openness to foreign trade, these sharp fluctuations in trade exchange affect a large share of their economies especially with the increasing importance of exports in China, India and Eastern Europe in the global economy. (Broda & Tille, 2003, p. 2)

These shocks can also be divided into local, internal, global or external shocks, according to the source of the shock and its type or nature, where we distinguish between internal sources (mechanisms for implementing monetary policy; central banks goals; beliefs of policymakers about the economy and its mechanism of action; monetary policy and political matters) (Al-Ghalibi & Mtawak, 2013, pp. 207,208), and external sources (discovery of new resources; change in the level of foreign investment; change in the value of exports). (Ben Yahya, 2016, p. 138)

3.3 Causes of trade exchange shocks:

The most important causes of trade exchange shocks can be summarized as follows: (Khalil, 2008, pp. 53,56)

- Reliance on a resource that does not have economic interconnections with the rest of the economic sectors, or almost a total dependence on a specific resource.

- Absence of sectors that stimulate change in the productive structure, like energy, transport, technology and communications sectors, which have a major role in overcoming shocks.

- Imbalance in the structure of foreign trade, that is, the lack of balance, whether on the quantitative or qualitative level of imported and exported goods and services.

- Price distortions within the price system for the country, and the lack of correct mechanisms that reflect the values and costs of goods, services.

- Imbalances in the labor market and high unemployment rates, due to the weakness of the productive sector and its inflexibility in absorbing the surplus labor as a result of rentier economy and the absence of productive sectors because of excessive import.

As for some internal causes which are considered structural, i.e. associated to the infrastructure of the production base, including: (Benzarour, 2001, p. 4)

- Weak substitution between exported, imported and locally consumed goods (not traded internationally);

- The incompatibility of imported goods with the GDP, which is mainly intended for consumption by the low-income class;

- Developing countries are subject to the conditions of a small country whose raw materials exports price is determined in the global market, and does not have the ability to determine it;

- The primitive nature of the capital market, whereby the banking system constitutes the main source of financial intermediation and works under restriction of lending and interest rates, which makes it difficult to mobilize and guide saving. This means depriving monetary policy of some of its tools to exercise the stabilization function;

- Mechanisms for implementing the fiscal and monetary policy, as the tools used in identifying and targeting economic variables such as output, inflation, prices and investment may be inaccurate in a way that is correspond with the nature of these variables in light of the current reality.

II. Fiscal policy response to trade exchange rate shock:
The impact of external shocks on fiscal policy variables is more apparent in developing countries than in developed countries and the ability to determine the impact of these factors is more difficult in developing countries. External trade shocks in developed countries affect the level of income and economic activity more than their impact on financial variables because the financial sector is not linked to the external sector, and therefore any change in financial variables is not directly related to external shocks, but it may appear as a result of a reaction policy by the government. (Ben Yahya, 2016, p. 164)

In order to clarify how the fiscal policy responds to shocks in the rates of trade exchange, we will divide them according to the type of policy into the following two points:

1. The response of the expansionary fiscal policy:
Fiscal policy is expansionary in response to the trade exchange shock if the latter is positive leading to an increase in government purchases (public expenditures) and reduce taxes, meaning that the fiscal policy is in direction with the economic cycle, as exposing the economy to a positive shock leads to the entry of the economy in an expansion phase (recovery), and this is reflected in fiscal policy direction towards corresponding the stage of recovery, and conversely if the economy is exposed to a negative trade exchange shock, the fiscal policy may respond, but in

an opposite way, as the drop in the rate of trade exchange leads to entering the recession phase of the economic cycle, and this sometimes requires that the fiscal policy be counter to the direction of the cycle in line with the recession phase that the economy is going through, so governments will tend to increase government purchases and reduce taxes. (Al-Tai & Ali Hussein, 2016, p. 6)

Economic cycles are a type of fluctuations present in the economic activity of countries in which work is organized mainly in institutions framework. The cycle consists of expansions that appear almost simultaneously in many economic activities, followed by general states of recession, deflation, and recovery that merge into the expansion phase of the coming cycle, and this series of changes is frequent, not cyclical. (Gordon, 2003, p. 3). The recovery phase is the first part of the expansion period, in which the general level of prices tends to be stable, economic activity increases slowly, interest rates decrease, the commodity stock decreases, and the demand is increasing to compensate for the shortage in the stock. This phase is also characterized by a clear expansion of bank credit with an increase in settlements and deposits. The result is that employment grows slowly and bank debts are fulfilled. In addition, this stage is characterized by a high level of production, a relatively low level of unemployment, a slight rise in prices, and an expansion lending. (Al-Wazani & Al-Rifai, 2006, p. 218)

2. The response of the recession fiscal policy:

The recession fiscal policy is imposed by policymakers if the economy is exposed to a positive trade exchange shock, as the fiscal policy may respond oppositely to the direction of the economic cycle, thus reducing government purchases and increasing taxes, and if the economy is exposed to a negative trade exchange rate shock.

the fiscal policy may respond in a pro-cyclical manner, reducing government purchases and increasing taxes. In both cases, it follows a recession fiscal policy and affects macroeconomic variables. It is observed that when the authorities follow a recession policy, they reduce spending or increase taxes or both, and when taxes are increased, there will be effects on consumption and investment and this will cause an increase in saving and investment, and the real interest rate will decline in the long term, and the same effect will occur if the government reduces its expenditures. (Mishkin & Eakins, 2012, pp. 79,81). The period of recession policy is also characterized by falling prices, and commercial panic as banks demand loans from customers, interest rates rise, production and income decrease, unemployment rates increase, and the volume of commodity stocks increases due to lack of demand. (Samuelson & others, 2001, p. 587)

II. The applied study of the fiscal policy response to shocks in trade exchange rate in Algeria in the period (1990-2018):

It seems clear that the fiscal policy in Algeria is tending to move towards devoting an expansionary and recovery financial policy, because the concentration was on supporting aggregate demand and not aggregate supply, especially after continuing in rising public spending. However, this is faced by complete absence of the local production system and this enhances the increase in the volume of imports in the future as the implementation of development programs continues to reach extreme

levels that may be difficult to bear in the future, and therefore decision makers are obliged to pay more attention to the issue of preparing and implementing the fiscal policy, and working to direct it according to the economic logic and not on the basis of personal, party and non-economic interests. (Saoudi & Guerrouf, 2012, p. 308)

1. Variables Set:

In this study, public revenues and public expenditures were used as dependent variables representing fiscal policy, and the rate of trade exchange as an independent variable.

Table 1: the variables used in the study model.

Variable symbol	Variable name	Unit of measure	Time period	Source of data
RE	public revenues	billion dinars	From 1990 to 2018	**Source of data** National Bureau of Statistics data from the website: http://www.ons.dz
EX	Public expenditures	billion dinars	From 1990 to 2018	
TOT	Trade Exchange rate	billion dinars	From 1990 to 2018	

Source : Prepared by researchers based on study variables.

2. Unit roots test:

We mean by stationary of a time series that its data fluctuates around a constant average of the series and there is no change in its variance, and several tests are used to clarify whether the series is stationary or not, but the most well-known is the Augmented Dickey-Fuller test (ADF), and since the random process may include a fixed limit or time direction, there are three different variations of the test, as shown in the following table:

Table 2: Unit Root Test Results.

At First Difference			At Level			Test	Variables
Non	Trend and Intercept	Intercept	Non	Trend and Intercept	Intercept		
-4.373961 (0.0001)	-4.461840 (0.0083)	-3.847895 (0.0051)	-4.348295 (0.0022)	-3.218027 (0.1021)	-2.662307 (0.0936)	**ADF**	**TOT**
-3.419858 (0.0014)	-4.729100 (0.0041)	-4.461461 (0.0016)	3.384355 (0.9995)	-1.487683 (0.8098)	1.118080 (0.9966)	**ADF**	**RE**
-0.714870 (0.3964)	-5.436392 (0.0009)	-5.590330 (0.0001)	2.498135 (0.9958)	-3.976929 (0.0256)	0.520718 (0.9844)	**ADF**	**EX**

At Second Difference				
Non	Trend and Intercept	Intercept	Test	Variables
-7.175352 (0.0000)	-7.112490 (0.0000)	-7.002477 (0.0000)	**ADF**	**EX**

Source: Prepared by researchers based on Eviews 9.0 outputs.

Through Table No: (2), it is shown after applying the Augmented Dickey Fuller test ADF, that the time series of the variables public revenue RE and trade exchange

rate TOT are stationary at the first difference and integrated of order one I (1), meaning that there is a possibility of a co-integration between public revenues and the rate of trade exchange in the long term, and that the public expenditures EX series is stationary at the second difference, so it is integrated of order two (I) 2 which indicates the absence of simultaneous co-integration between the public expenditures and the rate of trade exchange in the long term.

3. Estimating the impact of trade exchange rate on public revenues in Algeria for the period (1990-2018):

3.1 Determining the optimal lag period:

To determine the length of distributed lags, we use several criteria as shown in the following table:

Table 3: Results of determining the optimal lag period.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-409.6360	NA	6.87e+11	32.93088	33.02839	32.95793
1	-363.0773	81.94340*	2.29e+10*	29.52618*	29.81871*	29.60732*
2	-359.4715	5.769269	2.38e+10	29.55772	30.04527	29.69294
3	-357.8336	2.358590	2.93e+10	29.74669	30.42926	29.93600
4	-356.3281	1.927017	3.71e+10	29.94625	30.82384	30.18965

Source: Prepared by researchers based on Eviews 9.0 outputs.

Through the results of Table No: (3), and according to the criterion for selecting the optimal lag period, it became clear to us that the period 1 (Lag = 1) is the optimal

3.2 Co-integration test:

After performing the Johnson test on the VAR (1) model because the acceptable delay degree is p = 1, we found the following:

Table 4: Johansen Test for co-integration between Public Revenue and Trade Exchange Rate.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.382803	13.68106	15.49471	0.0921
At most 1	0.023850	0.651756	3.841466	0.4195

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Prepared by researchers based on Eviews 9.0 outputs.

Through Table (4), we note that the trace impact statistic (13.68106) is smaller than the critical value (15.49471) at 5% level of significance in the case of Non, and also in the case of At most1, where the trace statistic (0.651756) was smaller than the critical value (3.841466) At 05% level of significance, which means accepting the null hypothesis which states that there is no co-integration between public revenue and trade exchange rate chains in both directions.

3.3 Results of estimating the Vector Autoregressive model:

$$RE_t = 230.631 + 0.992 * RE_{t-1} - 0.279 * TOT_{t-1}$$
$$\quad\quad (-2.01877) \quad\quad\quad (21.4438) \quad\quad\quad (21.4438)$$

$\quad$ R^2 = 0.9680 $\quad\quad\quad$ F$_{STAT}$ = 378.164 $\quad\quad$ (.): t − student $\quad\quad$ n = 28

Through the results of estimating the VAR model, we note:

- The model parameters for RE $_{t-1}$, TOT $_{t-1}$ have a statistical significance at 5% and this indicates that:

- Public revenues for the previous year RE $_{t-1}$ affect current public revenues RE$_t$ positively.

- Trade exchange rate of the previous year TOT$_{t-1}$ affects current public revenues RE$_t$ inversely.

- There is a high quality correlation because R^2 = 0.9680, meaning that the public revenues for the previous year Ex$_{t-1}$ and the trade exchange rate for the previous year TOT$_{t-1}$ explain the current revenues RE$_t$ by 96.80%.

The model has a total statistical significance because the Fisher statistic F_{STAT} = 378.164 is greater than the value of Fisher distribution F (2,25, 0.05) = 3.38, and therefore the model as a whole is statistically acceptable.

4. Estimating the impact of trade exchange rate on public expenditures in Algeria for the period (1990-2018):

Through the study of the stability of variables, it was found that the trade exchange rate series is integrated of order one I(1), and that the public expenditure series EX is integrated of order two I(2), which indicates the absence of simultaneous co-integration between public expenditures and the rate of trade exchange in the long run.

4.1 Determining the optimal lag period:

To determine the length of distributed lags, we use several criteria as shown in the following table:

Table 5: Results of determining the optimal lag period.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-420.6049	NA	1.65e+12	33.80839	33.90590	33.83544
1	-370.7639	87.72024	4.23e+10	30.14111	30.43364	30.22224
2	-366.2132	7.281052	4.08e+10	30.09706	30.58461	30.23228
3	-339.4974	38.47074*	6.76e+09*	28.27979	28.96236*	28.46911*
4	-335.0475	5.695839	6.77e+09	28.24380*	29.12139	28.48721

Source: Prepared by researchers based on Eviews 9.0 outputs.

Through the results of Table No: (5), and according to the criterion for selecting the optimal lag period, it became clear to us that the period 3 (Lag = 3) is the optimal lag period for the estimation of the Vector Autoregressive model VAR.

4.2 Results of estimating the Vector Autoregressive model:

$$EX_t = 90.05 + 0.66 * EX_{t-1} - 0.01 * EX_{t-2} + 0.50 * EX_{t-3} + 0.50 * TOT_{t-1} + 0.06$$
$$* TOT_{t-2} + 0.15 * TOT_{t-3}$$
$$(-0.0733) \quad\quad (2.2562) \quad\quad\quad (1.7597) \quad\quad\quad (0.1627) \quad\quad\quad (0.3742)$$
$$(0.5519) \quad\quad (3.2323)$$

$R^2 = 0.9789$ $\quad\quad\quad\quad$ $F_{STAT} = 147.50$ $\quad\quad$ (.): $t − student$ $\quad\quad$ $n = 26$

Through the results of estimating the VAR model, we note:

- The model parameters for EX $_{t-1}$, EX $_{t-3}$ have a statistical significance at 5% and this indicates that public expenditures for the previous year EX $_{t-1}$ and the third year EX $_{t-3}$ affect current public expenditures EX $_t$ positively.

- The model parameters for Ex $_{t-2}$, TOT $_{t-3}$, in addition to the fixed limit have no statistical significance at the level of 5%. This indicates that public expenditures for the second year Ex$_{t-2}$ do not affect the public expenditures of the current year Ex$_t$, and that the rate of trade exchange for the previous year and for the second and third years does not affect public expenditures.

- There is a high quality correlation because $R^2 = 0.9789$, meaning that the model variables explain the current public expenditures by 97.89 %.

- The model has a total statistical significance because the Fisher statistic $F_{STAT} = 147.50$ is greater than the value of Fisher distribution F $(6,19, 0.05) = 2.63$, and therefore the model as a whole is statistically acceptable.

5. Granger Causality Test:

Granger's model is used in most time series studies and the causal relationship between economic variables is defined as the change in current and past values of a variable causes a change in another variable, and the following table shows the results of the study:

Table 6: Granger causality test.

VAR Granger Causality/Block Exogeneity Wald Tests			
Date: 06/15/20 Time: 21:59			
Sample: 1990 2018			
Included observations: 26			
Dependent variable: EX			
Excluded	Chi-sq	df	Prob.
TOT	7.538040	3	0.0566
All	7.538040	3	0.0566
Dependent variable: TOT			
Excluded	Chi-sq	df	Prob.
EX	66.96491	3	0.0000
All	66.96491	3	0.0000

VAR Granger Causality/Block Exogeneity Wald Tests			
Date: 06/16/20 Time: 12:31			
Sample: 1990 2018			
Included observations: 28			
Dependent variable: RE			
Excluded	Chi-sq	df	Prob.
TOT	4.075442	1	0.0435
All	4.075442	1	0.0435
Dependent variable: TOT			
Excluded	Chi-sq	df	Prob.
RE	0.888644	1	0.3458
All	0.888644	1	0.3458

Source: Prepared by researchers based on Eviews 9.0 outputs.

By conducting Granger Causality test, it became clear that:

- The rate of trade exchange causes the public revenues because the value of Chi-square Prob = 0.0435 which is less than 0.05 at 5% level of significance, and that the public revenues does not cause the rate of trade exchange because the value of Chi-square Prob = 0.3458 which is greater than 0.05 at 5% level of significance. In

other words, there is only one direction of causality from the rate of trade exchange to public revenues.

- The rate of trade exchange does not cause public expenditures because the value of Chi-square Prob = 0.0566 which is greater than 0.05 at the level of significance of 5%, and that the public expenditures cause the rate of trade exchange because the value of Chi-square Prob = 0.0000 which is less than 0.05 at 5% level of significance. In other words, there is only one direction of causality from public expenditures to the rate of trade exchange.

6. Impulse response function:

The Impulse response function reflects how each of the different variables of the model responds to any random shock in any change of the other variables of the model over time, and the following figure shows this function in relation to the study variables:

Figure 1: Impulse response functions.
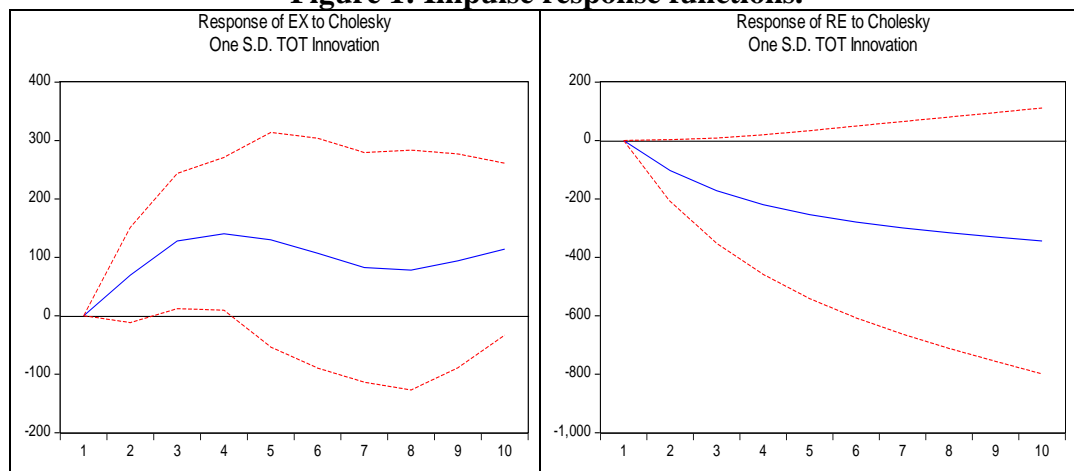
Source: Prepared by researchers based on Eviews 9.0 outputs.

Through Figure No: (1) above, it is clear that:

- For the impulse response of the public revenues to a random shock of one standard deviation in trade exchange, the effect of which was non-existent in the first year and then declined negatively until it reached -102,851 in the second year, then this effect continues to decrease gradually until the tenth year to reach -330,384, which means that any random shock in the rate of trade exchange affects directly public revenues negatively, starting from the second year.

- For the impulse response of the public expenditures to a random shock of one standard deviation in the rate of trade exchange, the effect was null in the first year and then it rises positively in the second year until it reach 140.33 in the fourth year, then gradually decrease from the fifth year to the eighth year. Then, it returns to rise in the ninth year until the tenth year to reach 114.03, which means that any random shock in the rate of trade exchange affects public expenditures in a positive fluctuating manner.

7. Analysis of Variance Decompositions:

The analysis of variance decompositions is one of the ways to describe the behavior of the model, in which the prediction of error variance of each variable is divided into two parts, the first part concerns the variable itself, while the other part concerns the other variables in the system, in other words, the expected error variance of a variable is due to unpredictable shocks for each variable of the model during this period, thus we can know the prediction variance for each variable due to a prediction error in the same variable, and the amount due to the prediction error in the other variables, then stand on how the impact of the shock that occurs in trade exchange rate for each used variable is transmitted through the response functions. The following table shows the analysis of variance of the study:

Table 7: Variance Decomposition.

Variance Decomposition of EX:				Variance Decomposition of RE:			
Period	S.E.	EX	TOT	Period	S.E.	RE	TOT
1	444.4761	100.0000	0.000000	1	328.2991	100.0000	0.000000
2	574.9388	98.53137	1.468629	2	487.2546	95.54438	4.455624
3	662.9040	95.17402	4.825982	3	629.8016	89.87114	10.12886
4	900.2410	94.95302	5.046979	4	764.7650	84.87389	15.12611
5	1113.375	95.33534	4.664656	5	894.1514	80.87760	19.12240
6	1223.778	95.37274	4.627263	6	1018.930	77.76530	22.23470
7	1319.709	95.62824	4.371756	7	1139.912	75.34557	24.65443
8	1415.613	95.89538	4.104624	8	1257.866	73.44928	26.55072
9	1497.804	95.93934	4.060657	9	1373.502	71.94571	28.05429
10	1590.495	95.88483	4.115168	10	1487.463	70.73809	29.26191

Source: Prepared by researchers based on Eviews 9.0 outputs.

From Table (7), it became clear that:

- With regard to the results of variance decomposition analysis of public revenues resulting from shocks of the same variable and the rate of trade exchange, the public revenues explain 100% of the expected error variance in the first year when a shock occurs by one standard deviation in the variable itself, then this percentage begins to gradually decrease starting from the year the second to become 95.54% because the rate of trade exchange now explains 4.45% of the expected error variance, then this decrease continues until it reaches 70.73% after ten years, while the rate of explanation of the rate of trade exchange for the expected error variance rises to 29.261%, and these results confirm the importance of the rate of trade exchange in the interpretation of public revenues during the various periods.

- As for the results of variance decompositions analysis of public expenditures resulting from shocks of the same variable and the rate of trade exchange, we notice that public expenditures explain 100% of the expected error variance in the first year when a shock occurs by one standard deviation in the same variable, then this percentage begins to gradually decrease starting from the second year to become 98.53% because the rate of trade exchange became explaining 1.46% of the expected error variance, then this decline continues weakly until it reaches

95.88% after ten years, whereas the rate of trade exchange rate explanation for the expected error variance increases to 4.11%, as it is considered a weak ratio, and that these results show that the rate of trade exchange explains public expenditures at a weak rate during different periods.

Conclusion:

The theoretical and applied study "Fiscal policy response measurement to the shocks of the rate of trade exchange in Algeria for the period (1990-2018)" revealed a set of results which can be summarized in the following points:

- The shocks of trade exchange rate in Algeria were related totally to the factor of dependence on oil exports, which directly contributed to the submission of this rate and its general budget to the fluctuations of the prices of this commodity in international markets.

- The oil sector was the major actor in the fiscal policy response to the trade shocks that the Algerian economy was exposed to, in addition to being the main cause of shocks.

- From the results of VAR model for estimating the effect of the rate of trade exchange on public revenues, it was found that the public revenues of the previous year affect the current public revenues directly, and that the rate of trade exchange for the previous year affects the current public revenues in a negative way, and that the variables public revenues for the previous year and the rate of trade exchange for the previous year explain the current public revenues by 96.80%.

- Through the results of VAR model for estimating the effect of the rate of trade exchange on public expenditures, it was found that the public expenditures for the previous year and for the third year affect the public expenditures of the current year directly. And that the variables public expenditures for the second year and the rate of trade exchange for the previous year and for the previous second and third years does not affect public expenditures, and that the variables of the model combined explain public expenditures for the current year by 97.89%

- After conducting Granger Causality test, the results showed that there is a one-way causal relationship from the rate of trade exchange to public revenue, and there is another one-way relationship from public expenditures to the rate of trade exchange.

- The impulse response function showed that the occurrence of any random shock in the rate of trade exchange affects public revenues negatively and directly starting from the second year, and that any random shock in the rate of trade exchange affects public expenditures directly, positive and fluctuating during the response period.

- When analyzing the variance decompositions, the importance of the rate of trade exchange in explaining public revenues during the different periods was revealed. It was also found that the rate of trade exchange explains public expenditures by a weak percentage during the different periods.

We can include as a global recommendation for this study, the necessity to work on diversifying the Algerian economy and its sources of income, as reliance on oil alone would make the national economy dependent on fluctuations in its prices and

production internally and to the external global conditions that cause crises that affect the oil sector inside.

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