The Relationship Between Select Macroeconomic Variables and Non-Hydrocarbon Tax In ALGERIA

العلاقة بين الجباية العادية و بعض المتغيرات الاقتصادية الكلية في الجزائر

Hadjmaoui Toufik [1], Benatek Hanane [2]

[1] **University of SAIDA. ALGERIA**, hadjmaoui_toufik@yahoo.fr
[2] **University of MASCARA. ALGERIA**, hanane.hadjemaoui@univ-mascara.dz,

Abstract:

The purpose of this research paper is to investigate the effect of real effective exchange rate (REER), inflation, economic growth and financial development on non-hydrocarbon tax revenue, in Algeria over the period of 1999 to 2018. Autoregressive Distributed Lagged (ARDL) model has been applied to find out long run and short run dynamics of models. The empirical findings suggest that the non-hydrocarbon tax revenues are not greatly responsive to changes in economic growth. And indicate that the REER is an important determinant of non-hydrocarbon tax revenue. In the short run, the results showed that the inflation has a strong positive effect on non-hydrocarbon tax. Meanwhile, the REER has had a low positive impact.

Keywords: non-hydrocarbon tax; economic growth; financial development; inflation; REER

Jel Classification Codes: E31**,** F31, H2, H60, O40.

ملخص:

الغرض من هذه الورقة البحثية هو دراسة تأثير سعر الصرف، التضخم، النمو الاقتصادي والتنمية المالية على إيرادات الجباية العادية في الجزائر خلال الفترة من 1999 إلى 2018. استخدمنا في هذه الدراسة منهج الحدود للتكامل المشترك، استنادا على نموذج الانحدار الذاتي للفجوات الزمنية الموزعة المتباطئة.

أظهرت النتائج التجريبية أن الجباية العادية لا تستجيب بشكل فعال للنمو الاقتصادي، وأن سعر الصرف الحقيقي يمثل أحد المحددات الهامة للجباية العادية. كما أظهرت النتائج أن كل من التضخم، الائتمان المقدم للقطاع الخاص والضرائب يتحركوا في نفس الاتجاه

وبوتيرة مختلفة. أما على المدى القصير فتشير النتائج أن للتضخم تأثير إيجابي كبير على الجباية العادية، في حين أن لسعر الصرف الحقيقي تأثير إيجابي منخفض.

كلمات مفتاحية: جباية عادية؛ تضخم؛ سعر صرف حقيقي؛ تنمية مالية؛ نمو اقتصادي.

تصنيف JEL: E31، F31، H2، H60، O40.

_____

Corresponding author: Hadjmaoui Toufik, e-mail: hadjmaoui_toufik@yahoo.fr.

1.INTRODUCTION:

The Algerian economy relies heavily on hydrocarbons, accounting for roughly 19,1 percent of GDP in 2017 (ONS Statistics), 60 percent of budget revenues, and more 90 percent of export earnings. The hydrocarbon sector was highly considered as the motor for development process, in contrast, other economic sectors are neglected. This increasing dependency has made the economic growth highly vulnerable to crude world oil prices volatility. The oil price shock, since mid-2014, has hit Algeria's economy hard and exposed the longstanding vulnerabilities of a growth model dependent on hydrocarbon and public spending (IMF, 2016, p. 1). Despite this strong sudden drop in the oil prices, the Algerian Real GDP growth slowed sharply from 3.8 percent in 2014 to 1.6 percent in 2017. This slowdown was mainly driven by a contraction in hydrocarbon production, which is estimated to have decreased by 1.4 percent in 2017. This contraction is mainly attributed to Lower OPEC quotas and weak external demand for gas from Europe (-3 percent) (IMF, 2018, p. 5). Meanwhile, growth in the non-hydrocarbon sector remains modest, despite the slight upturn from 2.3 in 2016 to 2.5 percent in 2017. This upturn is mainly attributed to the reversal of fiscal consolidation in the second half of 2017 (World Bank, 2018, p. 1).

Fig.1. Hydrocarbon and Non-Hydrocarbon GDP Growth
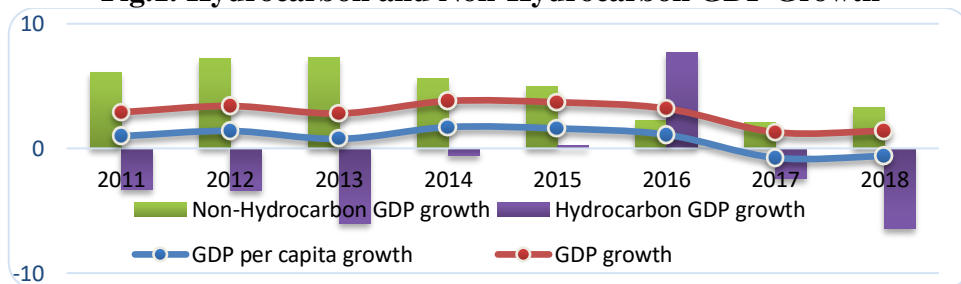
Source: Authors based on IMF and World Bank Data.

The current account deficit widened to 16.6 percent of GDP in 2016 from 4.4 percent in 2014 while hydrocarbon exports fell almost by half. Since then, Algeria has not been able to redress the balance through fostering non-hydrocarbon exports or sufficiently reducing import demand. The recent increase in oil prices has somewhat helped reduce the current account deficit, which is estimated at 9 percent of GDP for 2018. The current account deficit is projected to narrow significantly in the medium term, reflecting the impact of fiscal consolidation as well as hardened tariff and nontariff trade barriers (IMF, 2018, p. 48).

Fig.2. Current Account Balance
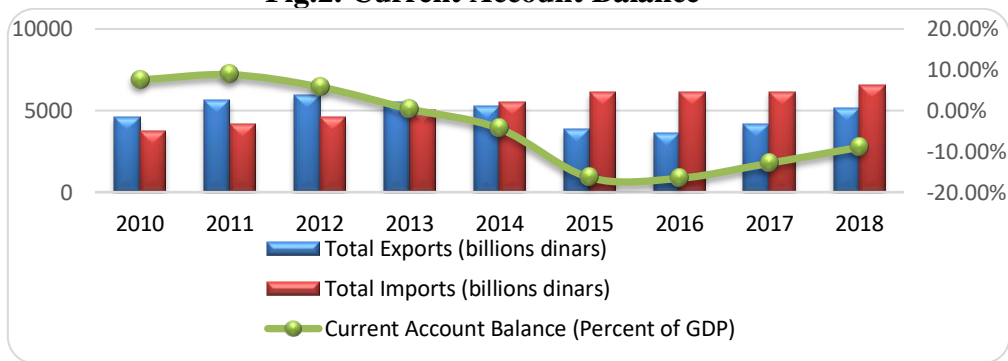
Source: Authors based on IMF Indicators.

In line with the decline in the overall balance of payments deficit, foreign exchange reserves contracted. It moved from US$ 178.94 billion at the end of December 2014 to US$ 88.61 billion at the end of June 2018 (Central Bank of Algeria, 2018, p. 5). This is due to two main factors; the actual decrease in the balance of payments by US$ 23.3 billion in 2017 compared to US$ 26.3 billion in 2016; and the exchange rate changes of foreign currencies, especially the dollar and the euro. The continued erosion of drain reserves will reduce the margin of response to external shocks in the future.

Table 1. Gross Official Reserves

| Algeria Gross Official Reserves	2014	2015	2016	2017	2018
In months of imports of goods and services	33	28	22.6	19.1	16.2
In billions of US$ dollars	177	143	113	96	78.6

Source: IMF (2018), Country Report No. 18/168

In terms of overall performance, it should be noted that hydrocarbon exports drop by 44.28%, going from DZD 5527.7 billion in 2012 to DZD 3080 billion in 2016, and then increased to reach DZD 4548.1 billion in 2018. Despite the net depreciation of Algeria's real effective exchange rate (REER) over the past years,

the non-hydrocarbons exports remain marginal in total exports. Exports of services are characterized by a strong increase in 2018 coupled with the positive growth in imports of services. Obviously, imports of services are weighing on external balances since they represent 6.86% of Non-hydrocarbon GDP while exports of services are only 2.45 % of NHGDP.

Imports of goods and services decreased in volume by 3.7% in 2018 and 7.1% in 2017 as a result of protectionist measures taken by Algerian authorities since 2015 to limit its import bill, and slow the loss of international reserves and promote import substitution by domestic production of non-oil and gas industries. The government has imposed additional restrictions on access to foreign exchange for imports, and import quotas for specific products, such as cars. In January 2018 the government replaced its import license system with a temporary ban on the import of about 850 categories of goods.5 It also extended the list of goods subject to a 30 percent excise tax and significantly increased customs duties (up to 60 percent) for other products (IMF, 2018, p. 10).

Fig.3. Hydrocarbon and Non-Hydrocarbon Exports
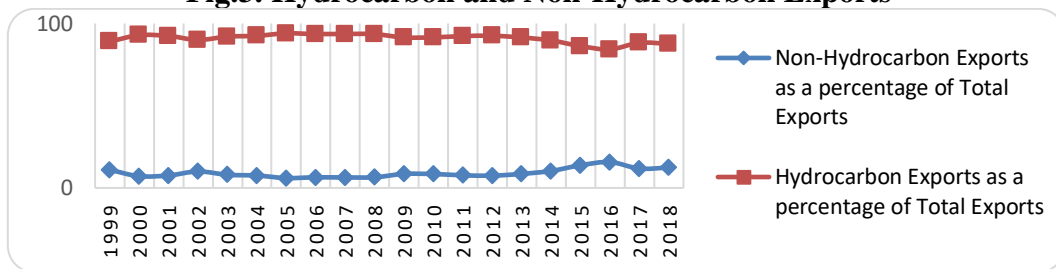
Source: Authors based on IMF Indicators.

Fig.4. Exports and Imports of Services
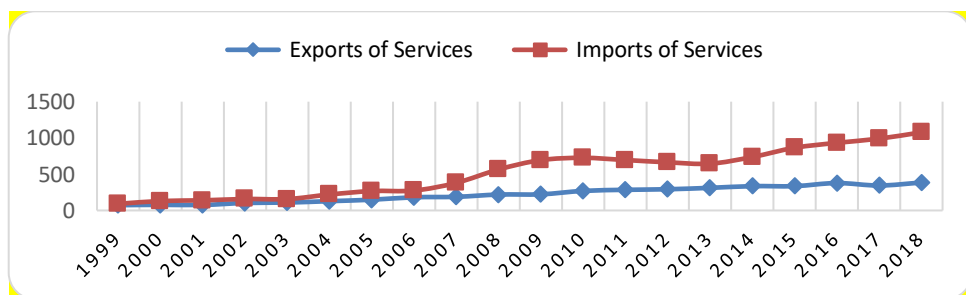
**Source:** Authors based on World Bank Data.

Like all developed and developing countries, Algeria seeks to achieve high growth and keep inflation at a low level. The Algerian economy had faced with inflationary trends over the recent years. Hence, average inflation continued to

accelerate in 2016, bringing the consumer price index to 6.4%, and then dropped to 4.27% in 2018, this increase does not seem to be a consequence of the classic determinants of inflation. Rather, it is mainly due to deficiencies in controlling Markets and to the dominant positions in most consumer goods markets.

Since the onset of the oil price shock, the dinar has depreciated by 31 percent against the dollar, helping to cushion the impact of lower oil prices. Over the same period, however, the REER has depreciated only by 8 percent because of higher inflation in Algeria than in its trading partners, but remains significantly overvalued, damaging Algeria's competitiveness. In 2017, both the nominal and real effective exchange rates depreciated (by 10 and 8 percent, respectively), mainly reflecting the movements of the dollar against major trading partners' currencies. The foreign exchange premium on the parallel exchange market stands at about 50 percent (IMF, 2018, pp. 48-49). In 2018, the exchange rate of the national currency also witnessed relative stability despite sharp moves, after a long series of depreciation, in the role of a near-single correction tool in front of the financial crisis (Central Bank of Algeria, 2018).

On the revenue side, Algeria is overly dependent on hydrocarbon revenues as the main resource of public treasury financing which fluctuate with volatile oil prices. Until 2011, the state still received the major share of its budget from hydrocarbon taxes, averaging 65.35 percent from 1993 to 2011, and a lessen share from non-hydrocarbon taxes (Ordinary taxes); this changed rapidly thereafter. From 2012 to 2017 the state obtained, in average, 42.08 percent of its fiscal revenues from hydrocarbon taxes.

Fig.5. Hydrocarbon and non-Hydrocarbon tax revenue
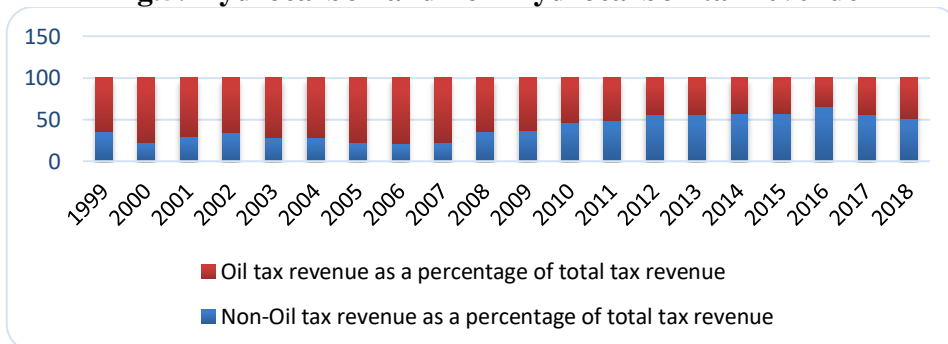
Source: Authors based on International Monetary Fund statistics.

The research Objectives:

This study aims to determine the dynamic relationship between these various variables: economic growth, Non-Hydrocarbon tax revenue, real effective exchange rate, inflation, and financial development. It is largely still true that the effect of these variables on Non-Hydrocarbon taxation is important and noteworthy though usually overlooked in Algeria's economic studies.

In this paper, we focus on Non-Hydrocarbon taxation stems from its importance as a stable resource for the state, especially that of petroleum levy is often exposed to earthquakes raised reflected negatively on the revenue.

The rest of this paper is structured as follows; the next section discusses the earlier literature looking the relationship between the variables under investigation. In section III, the data sources, the methodology and the empirical model will be presented. Section IV will be devoted to empirical findings and discussion while the final section contains conclusions and some policy recommendations.

2. Literature Review:

This section explores the relationship between Non-Hydrocarbon taxation, inflation, economic growth, real effective exchange rate and financial development. Many studies have put more attention to this relationship. We start by discussing the effects of inflation on taxation; a large literature emerged in the 1970s and early 1980s when inflation was high. However, the topic has received much less attention since the widespread decline of inflation rates in the mid-1980s (Herwig, 2000). Howard and Johnson (1988) showed that in the short run, an increase in the inflation rate of a small open economy may lead to some combination of a lower real after-tax interest rate and an expectation of a depreciation real exchange rate (Bayoumi & Gagnon, 1992, pp. 3-4).

(Bayoumi & Gagnon, 1992) indicate that in the world of mobile capital, the current system for nominal interest taxation implies that the cost of capital and the return to saving in each country are strongly and negatively correlated with the rate of inflation. It follows that a country's foreign asset position (and its current account balance) ought to be negatively correlated with its inflation rate. For OECD countries, cross-sectional regressions confirm that inflation rates are good predictors of current accounts, even after controlling for business cycles and government budget deficits. The Martin (Feldstein, 1981) study, based on the effects of the interaction between inflation and the taxation of capital income in American economy, showed that the interaction between inflation and existing tax

rules contributed to the fall in the ratio of share prices to real pretax earnings, or, equivalently, to the rise in the real cost to the firm of equity capital. He added that by reducing the real net return to investors and by widening the gap between the firms' cost of funds and the maximum return that they can afford to pay, the interaction between tax rates and inflation has depressed the rate of net investment in business fixed capital.

Furthermore, the relationship between inflation and economic growth in developed and developing countries has been a subject of interest to many researchers and policymakers. (Akinsola & Odhiambo, 2017) found in their study that the impact of inflation on economic growth varies from one country to another over time. They also revealed that it depends on the country's specific characteristics, the data set used, and the methodology employed. On balance, they found overwhelming support in favour of a negative relationship between inflation and growth, especially in developed economies. However, they confirm that there is still much controversy about the specific threshold level of inflation that is appropriate for growth. In this context, (Ruzima & Veerachamy, 2016) showed that there is no consensus on the relationship between inflation and economic growth both in theoretical and empirical studies. The results mostly depend on the assumptions adopted in the study. Accordingly, the theoretical literature indicates that the inflation-growth nexus can be positive, negative or neutral. Also, the empirical findings are diversified based on the economic conditions, methodology employed, data used, and nature of the study whether cross section, panel data or country specific, and time period of the study as well as the number of explanatory variables included in the model. Therefore, the empirical results have two models: linear and nonlinear relationships. In another study (Andres & Hernando, 1997) tried to determine the correlation among growth and inflation at the OECD level, within the framework of the so-called convergence equations, and to discuss whether this correlation withstands a number of improvements in the empirical models, which try to address the most common criticisms of this evidence. They have found that the negative correlation among growth and inflation is not explained by the experience of high-inflation economies; and the estimated costs of inflation are still significant once the country-specific effects are allowed for in the empirical model; and the observed correlation cannot be dismissed on the grounds of reverse causation (from GDP to inflation). In addition, (Anastassiou & Dritsaki, 2005), attempted to try to analyze

the relationship between total tax revenues, income tax and tax on capital gains, gross domestic saving and the rate of economic growth for Greece. The findings have shown that there exists causal relationship between tax revenues and economic growth.

Concerning the relationship between financial development and taxation, there have been few empirical studies which focused on analyzing this relationship. In one of the recent studies, we may mention (Bayar & Karamelikli, 2017) who have attempted to study the interactive relationship between tax revenues and the main indicators of financial development, represented by the banking sector development and the stock market in Turkey, The results showed that the banking sector development and the stock market would have had a positive impact on the total tax revenue, if the relationship between them were considered a non-linear one. For their part, (Ajide & Bankefa, 2017) tried to examine the effect of the financial system on the tax revenues collection in Nigeria. The results indicated that the variables of the financial system play a key role in the tax revenues collection. In another study, (Akram, 2016) attempted to analyze the role of financial markets in generating tax revenue in Pakistan, he showed that, in the long run, the number of bank branches and market capitalization has a positive and significant impact on tax revenue. While credit to the private sector has a bidirectional relationship with tax revenue, public sector credit has an insignificant impact. In the short run, only the number of bank branches and market capitalization has a significant impact on tax revenue.

3. Data sources, Model specification and Methodology:

3.1. Data and variables description:

To achieve the objective of this study, the annual data covering the period of 1999 to 2018 was used. Table (1) presents the data used and their sources. It is worthy to note that the data is transformed into logarithm so that the estimated parameters can be interpreted as elasticity.

Table 2. Description of variables and sources of data

Variable	Symbol	Source of data
Non-Hydrocarbon tax revenue (in log).	NHT	*National Office of Statistics.*
GDP Per capita: Current LCU, (in log).	GDPPC	The world Bank Data.
Domestic credit provided to the private sector, (in log).	DCPS	The world Bank Data.

| Real effective exchange rate index (2010=100), (in log). | LREER | The world Bank Data. |
| Consumer prices index (2010=100), (in log). | LCPI | The world Bank Data. |

Source: Authors

3.2. Model specification and Methodology:

The ARDL bounds testing approach is used to examine the impact of inflation, economic growth, real effective exchange rate and financial development on Non-Hydrocarbon taxation in Algeria. This approach has some advantages over the other co-integration techniques, such as: (Engle & Granger, 1987), (Johanson, 1992), (Johansen & Juselius, 1990), (Gregory & Hansen , 1996), (Saikkonen & Lütkepohl, 2000). For instance, this approach can be applicable if running variables have ambiguous order of integration i.e. purely I(0), purely I(1) or I(0) / I(1) which is not acceptable in traditional approaches. However, it requires that the dependent variable is of I(1) in levels and none of the explanatory variables is I(2) or higher.

The ARDL bounds testing approach is more suitable and provides better results than multivariate co-integration approaches in case of small sample properties (Fatukasi, Olorunleke, Olajide, & Alimi, 2015, p. 27).

The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F-statistic exceeds the critical value band (Nkoro & Uko , 2016, p. 2).

The model applied for this study, which express the linear relationship between Non-Hydrocarbon tax revenues and Economic Growth, real effective exchange rate, Inflation, Financial Development, is described in the following formula:

Non-Hydrocarbon tax revenues = f (Economic Growth, Inflation, Financial Development, Real effective exchange rate)…(1).

The logarithm is applied to all variables, the model can be restated as follows:

LNHT= f (LGDPPC, LCPI, LDCPS, LREER)… (2).

This equation can be reformulated as follows:

$$LNHT_t = \alpha_0 + b_1 LGDPPC_t + b_2 LCPI_t + b_3 LDCPS_t + b_4 LREER_t + \varepsilon_t \ldots (3)$$

where:

The dependent variable **LNHT** $_t$: Total Non-Hydrocarbon tax revenue. Our focus on Non-Hydrocarbon taxation stems from its importance as a stable

resource for the state, especially that of petroleum levy is often exposed to earthquakes raised reflected negatively on the revenue.

The explanatory variables:

$LGDPPC_t$: gross domestic product per capita (Current LCU). Is a proxy for the level of development of a country. A higher level of development goes together with a higher capacity to pay and collect taxes, as well as a higher relative demand for income elastic public goods and services (Hadjmaoui & Benatek, 2018, p. 112). In general, it is expected to have a positive impact on non-hydrocarbon tax revenue. The responsiveness of tax revenue to the change in the GDP of the country is a crucial factor for the development of the country. Making a fiscal policy decision without having the knowledge of the magnitude of the percentage change of tax revenues with GDP will undermine or over exaggerate the expectation of policy makers about the capacity of the economy to generate revenue (Tadele, 2015, p. 182).

$LDCPS_t$: Domestic credit provided to the private sector (Banks and financial institutions) is a proxy for the financial development. It might be expected that domestic credit provided to the private sector would be positively correlated with revenues.

$LREER_t$: Real effective exchange rate index (2010=100); Dinar per United States Dollar. Tanzi (1989) observes that there is often an inverse relationship between a country's tax revenue and the real level of its official exchange rate (Agbeyegbe, Stotsky, & WoldeMariam, 2004, p. 4). The depreciation of exchange rate would be expected to have a favorable effect on overall economic activity and thus increase tax revenue, and same as, an overvaluation of exchange rate would be expected to adversely affect overall economic activity, and thus lead to lower tax revenue (Masiya, Chafuwa, & Donda, 2015).

$LCPI_t$: Consumer prices index (2010=100). CPI values are used as a measure of inflation. Having a high inflation will have effectiveness on tax revenues due to its effect on consuming and investment; it also has a negative effect on the ability of contributor's participation (Hadjmaoui & Benatek, 2018, p. 113). Thus, a negative relationship is expected between inflation and tax revenue.

L: Natural logarithm.

This study uses ARDL bound testing method for examining co-integration among the variables. The functional form of the model becomes as:

According to the study by (Pesaran & Shin, 1995) and that of (Pesaran, 1997), the ARDL model can be constructed as:

$$\Delta LNHT_t = \alpha_0 + \sum_{i=1}^{p} a_1 \Delta LNHT_{t-i}$$

$$+ \sum_{i=0}^{q} a_2 \Delta LGDPPC_{t-i} \sum_{i=0}^{q} a_3 \Delta LCPI_{t-i} \sum_{i=0}^{q} a_4 \Delta LDCPS_{t-i} \sum_{i=0}^{q} a_5 \Delta LREER_{t-i}$$

$$+ b_1 LNHT_{t-1} + b_2 LGDPPC_{t-1} + b_3 LLCPI_{t-1} + b_4 LDCPS_{t-1} + b_5 LREER_{t-1}$$

$$+ \varepsilon_t \ldots (4)$$

Where:

α₀: Intercept.

a₁,a₂,a₃,a₄,a₅: Parameters of the short-run relationship.

b₁,b₂,b₃,b₄,b₅: Parameters of the long-run relationship.

p, q: The lag lengths.

εₜ: The error term.

In order to test co-integration among variables, the Wald F-Statistics for testing the join hypothesis has to be compared with the critical values as tabulated by (Perasan, Shin, & Smith, 2001).

The join hypothesis to be tested are as follows (A. Yimer, 2017, pp 133-135):

$$H_0: b_1 = b_2 = b_3 = b_4 = b_5 = 0$$
$$H_1: b_1 \neq b_2 \neq b_3 \neq b_4 \neq b_5 \neq 0$$

If F-Statistics is upper than bound critical values, the null hypothesis (H_0) is rejected, indicating that there is a long-run relationship between the lagged level variables in the model.

If F-Statistics is lower than bound critical values, the null hypothesis (H_0) is accepted, and no long-run relationship exists.

If calculated F-statistics is among (Perasan, Shin, & Smith, 2001)'s lower and higher critical values, the inference is inconclusive (No conclusion).

The representation of the error correction of the ARDL model is given by:

$$\Delta LNHT_t = \alpha_0 + \sum_{i=1}^{p} a_1 \Delta LNHT_{t-i}$$

$$+ \sum_{i=0}^{q} a_2 \Delta LGDPPC_{t-i} \sum_{i=0}^{q} a_3 \Delta LCPI_{t-i} \sum_{i=0}^{q} a_4 \Delta LDCPS_{t-i} \sum_{i=0}^{q} a_5 \Delta LREER_{t-i}$$

$$+ \theta \mu_{t-1} + \varepsilon_t \ldots (5)$$

Where:

a₁, a₂, a₃, a₄, a₅: Parameters of the short-run relationship.

θ: Adjustment rate coefficient (correction coefficient), which should be negative, as it indicates the rate at which the short-term relationship is close to the long-run equilibrium relationship.

ε_t: The term of errors

4. Empirical Findings and Discussion:

4.1. Unit Root Test:

In order to examine the integrating level of variables, PP (Philip & Perron, 1988) test has been used. The unit root results reported in Table (3) show that all the series are non-stationary at level but become stationary after taking their first difference i.e. I(1). Thus we apply ARDL bounds testing approach to co-integration to test long run relationship between the variables.

Table 3. PP unit root test results

| Variables	Level			First difference		
	Constant and trend	Constant	None	Constant and trend	Constant	None
LNHT	-1.29	-1.09	7.59	-4.29	-4.09	-1.48
LDCPS	-6.02	-3.50	4.30	-7.35	-5.62	-2.94
LGDPPC	-1.27	-3.09	3.77	-4.52	-4.23	-2.99
LREER	-2.26	-2.64	-2.04	-4.59	-4.61	-4.16
LCPI	-2.59	3.77	9.73	-7.7	-3.99	-4.22
Critical value	-4.53	-3.83	-2.69	-4.57	-3.85	-2.69
1%	-3.67	-3.02	-1.96	-3.63	-3.04	-1.96
5%	- 3.27	- 2.65	-1.61	- 3.29	- 2.66	- 1.61
10%						

Source: Authors

4.2. Determination of the Existence of the Long Run Relationship of the Variables

At the first stage the existence of the long-run relation between the variables under investigation is tested by computing the Bound F-statistic (bound test for co-integration) in order to establish a long run relationship among the variables. This bound F-statistic is carried out on each of the variables as they stand as endogenous variable while others are assumed as exogenous variables. In practice, testing the relationship between the forcing variable(s) in the ARDL model leads to hypothesis testing of the long-run relationship among the underlying variables.

4.3. Determine the optimal Lag Length for the ARDL Model

The appropriate lag order of variables should be determined before proceeding to the ARDL bounds testing approach to co-integration (Perasan, Shin, & Smith, 2001). In order to determine the number of lags length of variables included in the ARDL model, we used the Akaike Information Criterion (AIC). Figure (6) shows that the model ARDL (1,1,0,0,1) is optimal among other models, because it gives us the smallest value of AIC and avoids the spuriousness of ARDL bounds testing approach to co-integration results (model without the problem of autocorrelation errors, no problem of heteroscedasticity).

Fig.6. Optimal Lag Length (p, q) of the ARDL model

Akaike Information Criteria
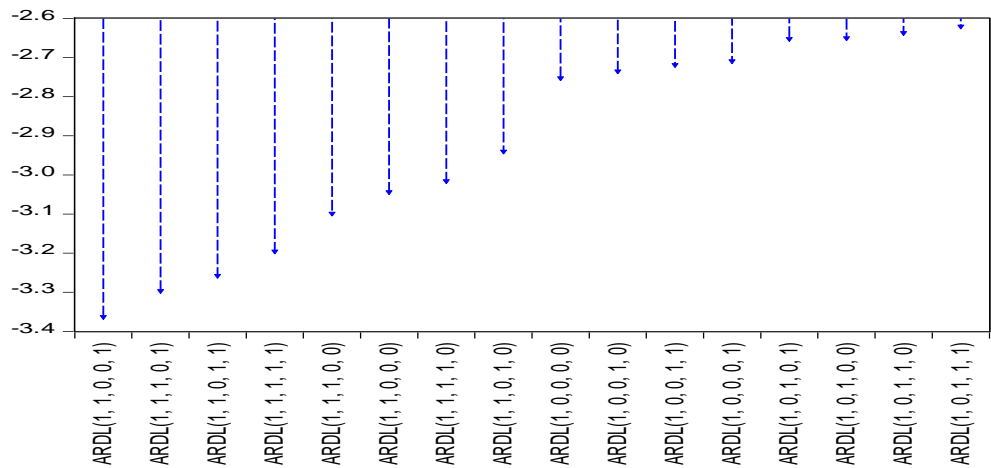
Source: Authors

4.4. Determination of the Existence of the Long Run Relationship of the Variables

At the first stage, the existence of the long-run relation between the variables under investigation is tested by computing the Bound F-statistic (bound test for co-integration) in order to establish a long run relationship among the variables.

The results of the ARDL bounds testing approach are also shown in Table (4). It is clear that computed F-statistic is greater than the upper bound critical value proposed by (Perasan, Shin, & Smith, 2001) for the different thresholds of significance (1%, 5%, 10%). And that the Calculated t-statistic is also greater than the tabular values. These results confirm the rejection of the null hypothesis of the absence of a long-run relationship.

Table 4. ARDL Bounds Test

F-Bounds Test	Null Hypothesis: No levels relationship

The relationship Between Select Macroeconomic variables and Non-Hydrocarbon Tax in Algeria

| Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.840391	10%	2.45	3.52
k	4	5%	2.86	4.01
		1%	3.74	5.06

Source: Author's calculations.

4.5. Estimating long-run relationship among variables:

After confirming the existence of a co-integration relationship, between the dependent variable, here total Non-oil tax revenues, and the various explanatory variables represented by the gross domestic product per capita, consumer price index, real effective exchange rate and domestic credit provided to the private sector, we estimate the long-run relationship according to equation (4) above.

The long run results of the study are reported in table (5). The first thing to note is that the coefficients of the explanatory variables are positive and statistically significant in regression. As earlier postulated, the economic growth as measured by GDPPC has a positive and statistically significant impact on non-hydrocarbon tax revenue. On average, an increase in the GDP per capita by 1 percent lead in the long run to an increase of 0.6 percent in the non-hydrocarbon tax revenue. This trend shows the non-hydrocarbon tax revenue are not greatly responsive to changes in GDP per capita.

The results indicate that the real effective exchange rate (REER) is an important determinant of non-hydrocarbon tax revenue. Contrary of what was expected, the REER has an important positive impact on non-hydrocarbon tax revenue. It implies that for a one percentage increases in REER revenue from non-hydrocarbon tax grows on average by 1.76 percent. These results are consistent with the findings of (Ghura, 1998). This relation could be explained by the greater dependence of tax receipts on import rather than exports taxes (non-oil exports). The figure (7) shows the big difference between non-oil exports and imports of goods and services.

Fig.7. Exports and Imports of goods and services
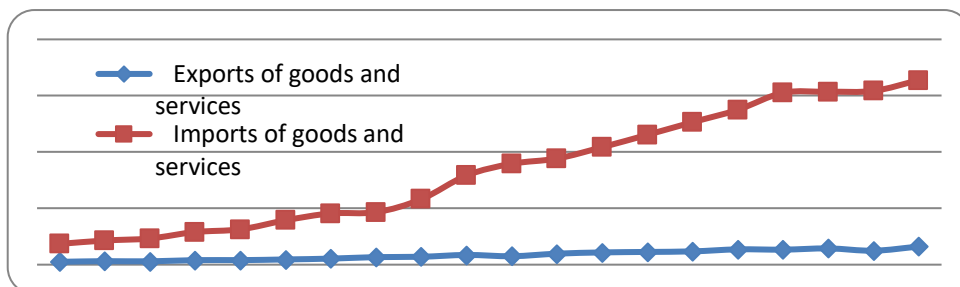
Source: Authors based on International Monetary Fund statistics.

Furthermore, the impact of the inflation, as measured by consumer price index, on the non-hydrocarbon tax revenue is positive and statistically significant. So any increase in inflation by 1 percent will cause an increase in the non-hydrocarbon tax revenue, but less than1. In other words, inflation and taxes move in the same direction but with different magnitude. The estimated results are consistent with the findings of (Loganathan, Suraya , Streimikiene, & Golam Hassan, 2017) and (Patoli, Zarif , & Syed, 2012). Similarly, domestic credit provided to the private sector (DCPS) is positively linked to non-hydrocarbon tax revenue in Algeria. So an increase in DCPS will lead to enhanced revenue collections.

Table 5. The estimated long-run coefficients

Variables	Coefficient	Standard error	t-Statistic	P-value
LDCPS	0.37	0.32	2.36	0.0379
LGDPPC	0.6	0.15	2.56	0.0264
LREER	1.76	0.14	4.32	0.0012
LCPI	0.75	0.44	4.00	0.0021

Source: Author's estimates.

4.6. Short-Run Coefficients Estimates of Model:

The short-run relationship is estimated using the Error Correction Model (ECM) according to equation (5) mentioned above. The results of short run dynamic are shown in table (6) which indicate that the value of ECM (Coint Eg (-1)) is negative and significant at a level of 5% which is theoretically correct. This confirms the existence of a correction mechanism error. This coefficient expressing the degree to which the tax revenue variable will be converging in long equilibrium, is estimated at -0.06 for our ARDL model. In other words, the difference in the short-run tax revenue index will be corrected in the long-run by 6% of each period until it reaches a long-run equilibrium.

In addition, the results showed the inflation which seems to have a positive effect on the non-hydrocarbon tax perception of short-run, and the magnitude of

the impact is much stronger than that of the long-run impact. Meanwhile, the real effective exchange rate has had a low positive impact.

Table 6. The estimated short-run coefficients

Variables	Coefficient	Standard error	t-Statistic	P-value
Constant	-9.02	1.44	-6.25	0.0001
D(LCPI)	2.78	0.54	5.13	0.0003
D(LREER)	0.15	0.23	0.68	0.5127
CointEg(-1)	-0.06	0.09	-6.31	0.0001
R-sq	0.71	DW	2.24	

Source: Author's estimates:

4.7. Robustness tests of the estimated ARDL model:

To test the validity of the estimated ARDL model we used some tests, such as the Breusch-Godfrey (LM) serial correlation test, the Jarque-Bera (JB) test for residue normality, and the hetero scedasticity test. The results obtained, presented in Table (7), confirm the absence of serial correlation, the absence of hetero scedasticity, and the normality of the residues.

Table 7. Diagnostic tests of ARDL model

Tests	Statistic	Value	Prob
Autocorrelation:	F- Statistic	0.37	0.6957
	chi-squared	1.47	0.4790
Breusch-Godfrey			
Normality: Jarque-Bera	Jarque-Bera	2.92	0.23
Heteroskedasticity:	F- Statistic	0.37	0.9023
	chi-squared	3.61	0.8233
Breusch-Pagan-Godfrey			

Source: Author's calculations.

4.8. Stability test of the model:

The stability test is used to check the stability of the model and the compatibility of the long-run parameters with their counterpart in the short-run. The cumulative sum of Recursive Residuals (CUSUM) and the cumulative sum of squares Recursive Residuals (CUSUMQ) tests method proposed by (Brown, Durbin, & Evans, 1975) were used. Figure (8) shows that the both CUSUM and CUSUMQ remain, at all times, within the area restricted by the lines, thus, the estimated ARDL model is effective with stable recursive residuals.

Fig.8. CUSUM and CUSUM of Square
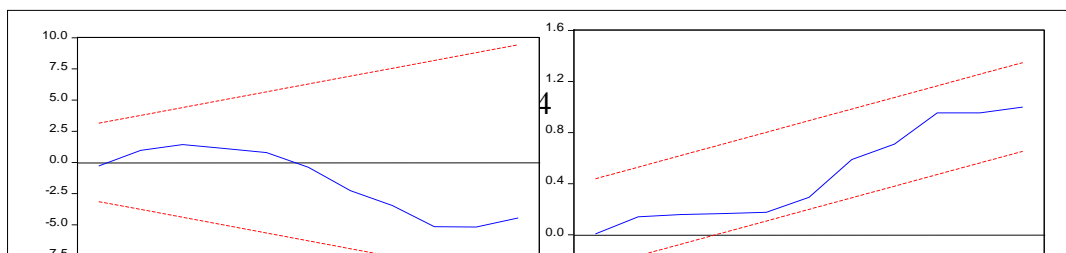
Source: Author's calculations.

5. CONCLUSION:

The present paper attempted to examine the impact of economic growth, inflation, financial development, and real effective exchange rate on non-hydrocarbon tax revenues in Algeria for the period 1999 – 2018.

The findings of the present study are:

-The real effective exchange rate (REER) is an important determinant of non-hydrocarbon tax revenue. Contrary of what has been expected, the REER has an important positive impact on non-hydrocarbon tax revenue. It implies that for a one percentage increase in REER revenue from non-hydrocarbon tax grows on average by 1.76 percent. These results could be explained by the greater dependence of tax receipts on import rather than exports taxes (non-oil exports). In the short-run, the real effective exchange rate has had a low positive impact.

-The economic growth as measured by GDPPC has a positive and statistically significant impact on non-hydrocarbon tax revenue. On average, an increase in the GDP per capita by 1 percent lead in the long run to an increase of 0.6 percent in the non-hydrocarbon tax revenue. This trend shows that the non-hydrocarbon tax revenues were non-buoyant. In other words, the tax system is not proportional responsive with the economic growth change in Algeria, and not generating enough revenue.

-Domestic credit provided to the private sector (DCPS) is low positively linked to non-hydrocarbon tax revenue in Algeria, and it could be explained by the weak effectiveness of these loans in generating tax revenues.

-This study finds effect from the short run dynamics between consumer price index and non-hydrocarbon tax revenue. The inflation seems to have a positive effect on the non-hydrocarbon tax perception of short-run, and the magnitude of the impact is much stronger than that of the long-run impact.

In order to improve the non-hydrocarbon collection, we suggest adopting these recommendations:

-To collect additional non-hydrocarbon tax revenues, Algerian government must take deep structural reforms to facilitate an economic diversification, working on raising the non-hydrocarbon tax through eliminating the shadow economy, and dealing decisively with tax evaders. Various papers and studies have shown that the existence of the shadow economy has implications for the tax system, and the changing in ratio of the shadow economy to GDP is correlated to changing in ratio of tax collection to GDP (Awasthi & Engelschalk, 2018, p. 3).

-The policymakers must look at the critical position of taxes which are inflation-oriented, rather production or investment oriented.

Bibliography List :

Agbeyegbe, T., Stotsky, J., & WoldeMariam, A. (2004). Trade Liberalization, Exchange Rate Changes, and Tax Revenue in Sub-Saharan Africa. *IMF working paper*, 1-31.

Ajide, F., & Bankefa, O. (2017, November). Does financial system influence tax revenue? The case of Nigeria. *African Journal of Economic Review, 5*(3), 15-33.

Akinsola, F., & Odhiambo, N. (2017). Inflation and Economic Growth: a Review of The International Literature. *Comparative Economic Research, 20*(3), 41-56.

Akram, N. (2016). Do Financial Sector Activities Affect Tax Revenue in Pakistan? *The Lahore Journal of Economics*, 153-169. doi:10.35536/lje.2016.v21.i2.a6

Anastassiou, T., & Dritsaki, C. (2005, February). Tax Revenues and Economic Growth: An Empirical Investigation for Greece Using Causality Analysis. *Journal of Social Sciences · February 2005*, 99-104.

Andres, J., & Hernando, I. (1997). Does Inflation Harm Economic Growth? Evidence for the OECD. *NBER Working Papers 6062*, 1-31.

Awasthi, R., & Engelschalk, M. (2018). Taxation and the Shadow Economy : How the Tax System Can Stimulate and Enforce the Formalization of Business Activities. *Policy Research Working Paper;No. 8391*, 1-15.

Bayar, Y., & Karamelikli, H. (2017). Financial Development and Tax Revenues in Trkey: A Non-Linear Cointegration Analysis. *The European Journal of applied economics*, 31-42. doi:10.5937/ejae14-14838

Bayoumi, T., & Gagnon, J. (1992). Taxation and inflation: a new explanation for current account imbalances. *International Finance Discussion Papers*(420), 1-43.

Brown, R., Durbin, J., & Evans, J. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society. Series B (Methodological), 37*(2), 149-192.

Central Bank of Algeria. (2018). *Monetary and financial bulletin - 1st semester.* Algiers: Central Bank of Algeria.

Engle , R., & Granger, C. (1987, March). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica, 55*(2), 251-276. doi:10.2307/1913236

Fatukasi, B., Olorunleke, G., Olajide, G., & Alimi, S. (2015). Bounds Testing Approaches to the Analysis of Macroeconomic Relationships In Nigeria. *European Journal of Business and Management, 7*(8), 26-34.

Feldstein, M. (1981, May). Inflation, Capital Taxation, and Monetary Policy. *NBER working paper*, 1-35.

Ghura, D. (1998). Tax Revenue in Sub-Saharan Africa: Effects on Economic Policies and Corruption. *IMF working paper, WP/98/135*, 1-25.

Gregory , A., & Hansen , B. (1996). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics, 70*(1), 99-126.

Hadjmaoui, T., & Benatek, H. (2018). Tax Capacity and Tax Effort of ALGERIA from 1981 to 2014, Strategy and Development Review. *Strategy and Development Review, 8*(15), 109-124.

Herwig, I. (2000). The Impact of Inflation on Income Tax and Social Insurance Contributions in Europe. *EUROMOD Working Papers EM2/00*, 1-30.

IMF. (2016). *Country Report No. 16/127.* Washington: International Monetary Fund.

IMF. (2018). *Country report No. 18/168.* Washington: International Monetary Fund.

Johansen , S., & Juselius, K. (1990, May). MAXIMUM LIKELIHOOD ESTIMATION AND INFERENCE ON COINTEGRATION — WITH APPLICATIONS TO THE DEMAND FOR MONEY. *Oxford Bulletin of Economics and Statistics, 52*(2), 169-210. doi:doi.org/10.1111/j.1468-0084.1990.mp52002003x

Johanson, S. (1992, August). DETERMINATION OF COINTEGRATION RANK IN THE PRESENCE OF A LINEAR TREND. *Oxford Bulletin of Economics and Statistics, 54*(3), 383-397. doi:10.1111/j.1468-0084.1992.tb00008.x

Loganathan, N., Suraya , I., Streimikiene, D., & Golam Hassan, A. (2017, December). Tax reform, inflation, financial development and economic growth in Malaysia. *Romanian journal of economic forecasting, 20*(4), 152-165.

Masiya, M., Chafuwa, C., & Donda, M. (2015, January). *Determinants of Tax Revenue in Malawi.* Consulté le February 2020, sur Masiya, Michael and

Chafuwa, Chiyembekezo and Donda, Mwayiwawo, Determinants of Tax Revenue https://ssrn.com/abstract=2887852 or http://dx.doi.org/10.2139/ssrn.2887852: Masiya, Michael and Chafuwa, Chiyembekezo and Donda, Mwayiwawo, Determinants of Tax https://ssrn.com/abstract=2887852

Nkoro, E., & Uko , A. (2016). Autoregressive Distributed Lag (ARDL) Cointegration Technique: Application and Interpretation. *Journal of Statistical and Econometric Methods, 5*(4), 63-91.

Patoli, A., Zarif , T., & Syed, N. (2012). Impact of Inflation on Taxes in Pakistan: An Empirical Study of 2000-2010 Period. *Journal of Management and Social Sciences, 8*(2), 31-44.

Perasan, H., Shin, Y., & Smith, R. (2001, June 22). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics, 16*(3), 289-326.

Pesaran, H. (1997). The role of economic theory in modelling the long run. *The economic journal, 107*, 178-191.

Pesaran, H., & Shin, Y. (1995). Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. *Cambridge Working Papers in Economics 9514, Faculty of Economics, University of Cambridge*, 1-33.

Ruzima, M., & Veerachamy, P. (2016). Impact of inflation on Economic Growth: A Survey of Literature Review. *International Multidisciplinary Research Journal, Golden Research Thoughts*, 1-9.

Saikkonen, P., & Lütkepohl, H. (2000). Testing for the Cointegrating Rank of a VAR Process with Structural Shifts. *Journal of Business & Economic Statistics, 18*(4), 451-464.

Tadele, B. (2015, January). Analysis of Tax Buoyancy and Its Determinants in Ethiopia (Cointegration Approach). *Journal of Economics and Sustainable Development www.iiste.org, 6*(3), 182-194.

World Bank. (2018). *The world bank annual report 2018.* Washington: World Bank Document.