MEASURING THE IMPACT OF DOMESTIC SAVING ON ECONOMIC GROWTH IN ALGERIA USING ARDL MODEL

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SUMMARY

This study examines the impact of domestic saving on Algeria's economic growth in the short and long run, using the auto regressive distributed lag model (ARDL) for the period 1980-2018. The results indicate the significant short and long run effects of saving on economic growth in Algeria's case, where saving levels are high and very positive with the level of economic growth. In this context, the study recommends measures to mobilize domestic saving; considering them as the right way to finance capital accumulation, to develop the national economy, and to push it for appropriate and acceptable growth rates.

KEY WORDS: Domestic Saving, Economic Growth, Algerian economy, dynamic models, ARDL Model.

JEL CLASSIFICATION: C32, E21, O16, O41

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MESURER L'IMPACT DE L'EPARGNE DOMESTIQUE SUR LA CROISSANCE ECONOMIQUE EN ALGERIE A L'AIDE DU MODELE ARDL

RÉSUMÉ

Cette étude examine l'impact de l'épargne domestique sur la croissance économique algérienne à court et à long terme, à l'aide du modèle d'Auto-régression (ARDL) pour la période 1980-2018. Les résultats indiquent les effets significatifs de l'épargne sur l'économie à court et à long terme sur la croissance en Algérie, où les niveaux d'épargne sont très positifs avec le niveau de croissance économique. Dans ce contexte, l'étude recommande des mesures pour mobiliser l'épargne intérieure; les considérant comme le moyen approprié de financer l'accumulation de capital, de développer l'économie nationale et de la pousser à des taux de croissance appropriés et acceptables.

MOTS CLÉS : épargne domestique, croissance économique, économie algérienne, modèles dynamiques, modèle ARDL.

JEL CLASSIFICATION: C32, E21, O16, O41

قياس أثر الادخار المحلي على النمو الاقتصادي في الجزائر باستخدام نموذج ARDL

ملخص

تبحث هذه الدراسة في أثر الادخار المحلي على النمو الاقتصادي في الجزائر على المديين القصير والطويل، باستخدام نموذج الانحدار الذاتي للفجوات الزمنية الموزعة المتباطئة (ARDL) للفترة من عام 1980 إلى عام 2018. تشير النتائج إلى التأثيرات الهامة على المديين القصير والطويل للادخار على النمو الاقتصادي في حالة الجزائر، حيث تكتسب مستويات الادخار علاقة كبيرة وإيجابية للغاية مع مستوى النمو الاقتصادي. في هذا السياق، توصي الدراسة باتخاذ اجراءات لتعبئة المدخرات المحلية، باعتبارها الأسلوب الصحيح لتمويل تراكم رأس المال، وتنمية الاقتصاد الوطني، ودفعه نحو تحقيق معدلات نمو مناسبة ومقبولة.

كلمات مفتاحية:

ادخار محلي، نمو اقتصادي، اقتصاد جزائري، النماذج الديناميكية، نموذج ARDL.

تصنيف جال: C32، E21، O16، O41

INTRODUCTION

Saving is of great importance to any country, as one of the main sources of financing economic development processes, if not the most important. It is also one of its means of achieving economic growth in most countries at all levels, especially developing ones, which are in dire need of such saving for financing their investment. It is well-known that accelerating economic growth is a life-need for developing countries, no matter how sophisticated they may be, since only a significant increase in growth rates will enable them to develop and eliminate the huge gap that separates their economies from the economies of developed countries. Therefore, the issue of saving development is one of the most important issues of growth and development.

Talking about the possibility of development without the necessary funds is far from logic and reality, since the beginning of the process of economic development requires the allocation of funds necessary and sufficient to the requirements of economic activity. Hence the importance of domestic saving in providing the economy with the necessary funding for the implementation of development programs appears. The creation and implementation of many new productive projects and the expansion of the productive capacity of old enterprises are not easy or simple to make a significant boost to economic growth. All this requires a large amount of capital to finance these projects, i.e., a sufficient rate of saving is required; the latter is an important source of auto-financing in investment expansion operations. Such investments, which are in the form of effective economic entities or enterprises, will increase the scope of the domestic productive base and reduce the impact of the decline in oil revenues on the structure of the national economy. Savings are therefore of great importance in accelerating the development process and the best way to finance huge and ambitious investment programs, so stimulating economic growth.

Sensing the importance of domestic saving in pushing towards appropriate and acceptable rates of economic growth, so the main problematic that we seek to address is the following key question:

Is there a cointegration relationship between domestic saving rates and economic growth in Algeria during the period (1980-2016)?

Based on the foregoing, we have adopted the following hypothesis as the basis and starting point for discussion of the subject: there is a cointegration relationship between domestic saving rates and economic growth in Algeria.

To test this basic hypothesis, the study will rely on the World Bank's database of global development indicators. (World Development Indicators).

1- SAVING AND ITS RELATIONSHIP TO GROWTH IN ECONOMIC THEORY

Economic growth means change with a steady increase in national output in general and in per capita output in particular. Saving is the remaining part of income after consumer spending, which is geared towards investment and capital formation, with other factors identifying real income growth in the national economy. Thus, these introductions result in the effect of changes in the savings rate on real income growth rates, and thus economic growth rates. Therefore, the relationship between saving and economic growth is a direct one because increasing saving rates rise the rate of economic growth and vice versa. Under low savings rates, it is difficult to achieve high rates of investment; this decline in savings and investment levels hinders growth opportunities. Real constraints on economic growth are mainly reflected in inadequate savings and investment (Denis Kessler & Jean Peyrelevade, 1992). Therefore, increasing domestic saving is necessary and vital, and a preferred option to drive the economy out of crisis, and achieve an appropriate and acceptable economic growth rate, especially since foreign saving in developing country are no more than 5% of GDP (Abd El Aziz Qasim Mhareb, 2011). Saving that expresses a time balance that reflects the future consumption preference (Pierre Volle, 2006) are also important for the provision of insurance against economic and social shocks (Schubert Katheline, 1992), which is mainly earmarked for the absorption of such shocks in the short term of income, in order to maintain the trajectory of consumption growth (Coudert Virginie, 1990).

1.1- Saving in classical school

The issue of saving is one of the most important issues on which economic thought has been focused as a pillar of economic development. The economist R. Nurkse has attributed the poverty experienced by developing countries to the inability of individuals to save, which means low capital supply and low economic growth rate (Ramzi Zaki, 1966).

The classical people have been interested in economic growth and the reasons for increasing the wealth of nations, and with the great traditional Smith and Ricardo, appear the interest in saving and its fruitful use. Smith offers a model of increased wealth and prosperity is based on giving great importance to the base of capitalist accumulation, which results from the desire of the wealthy to create saving and then direct it towards investment, and then the classical theory is called 'accumulation theory'. Every economic boom is conditional on a former capitalist formation, and for this to be achieved it must be preceded by saving. Smith says in his book the wealth of nations 'Capital is increasing by saving and decreasing with waste and mismanagement... and the industry that is making more saving, what could have been given without saving'. On this basis 'the increasing of saving lead to the increasing of fixed capital, i.e. the further expansion of the real industries, then increasing the amount of the product work used, allowing a greater division of social work and raising the level of productivity, which increases the quantity and value of total production, towards the well-being of the population (Moufid Helmi, 2008).

Adam Smith asserts that abundant savings and free trade are the necessary and sufficient conditions for economic growth (Henri Denis, 1971). The traditional people, especially Ricardo, gave particular importance to the profits, because it is the capitalist class, in their eyes, who accumulate capital.

1.2- Saving in economic growth models

There are many schools of thought dealing with saving and its role in the economy, especially after the Second World War and during the fifties and the sixties of the 20th century, during which several models of economic growth emerged, interested in the search for factors that lead to the continuation and the increase of the growth rate of national income, and the importance of saving appeared in many of those models. So we will shed light on the importance of saving in four models, namely : A.Lewis model, Harrod-Domar model, the Solo model and the golden model of Phillips E.S.phillips.

1.2.1. Saving in Arthur-Lewis model

Lewis has given savings a crucial role in the economic growth process, as the obstacle to further investment in less developed countries is that the marginal propensity for savings is very low (Mohamed Abd El Ghaffar, 1997). Lewis pointed to the importance of real savings in the development process in developing countries, considering that the main problem in the development process was the inability of most developing countries to mobilize the real savings needed to implement development programs. Lewis had seen in the savings that it was the primary driver of economic development (Ma Guonan & Yi Wang, 2010). Lewis also stressed that the essence of economic development is limited to a significant increase in capital accumulation, including knowledge and competencies.

Lewis has assessed the relationship between the saving rate and the level of development (average per capita income), where he believes that in underdeveloped (poor) countries the saving rate increases with the growth of average per capita, especially in the capitalist sector. However, in the more developed countries, there is a weak excuse to expect a positive correlation between the saving rate and the average of an individual's income (Mohamed Abd El Ghaffar, 1997).

1.2.2. Saving in Harrod-Domar model

The new Keynesians such as Harrod Domar stressed that saving is the important element of capital accumulation, and if economic growth rates are raised, increased saving will lead to a fruitful rise in capital; thus, increasing production and growth, by increasing the supply of capital that will reduce the benefit rate, and this would encourage investment, and then increase production and growth. The economic mechanism through which more investment leads to further growth can be described in the form of the Harrod Domar growth model. The latter is one of the most famous growth models of economic thought. It determines the rate of economic growth based on the important role of saving, and this model assumes that the element of capital is the rare determinant of growth (Ramzi Zaki, 1966). It also emphasizes that saving can only be sustained in an economy capable of producing productive goods. This model was first used in developing countries, to determine growth rates in the first five years plan in India during the period 1951-1956 (Maher Sharif, 2000). Harrod Domar (Todaro and Smith, 2006) sees:

Saving S is a percentage of the national income Y, so we form the following simple equation:

$$S = s\,\mathrm{Y}. \qquad (1)$$

Where s is a proportion.

Investment is defined as the change in capital balance as follows :

$$I = \Delta K. \qquad (2)$$

Because the total capital balance K is directly related to gross national income or output Y in accordance with the capital/output coefficient, then k is as follows:

$$k = \frac{\Delta \mathrm{K}}{\Delta \mathrm{Y}} \Rightarrow \Delta \mathrm{K} = k\,\Delta \mathrm{Y}. \qquad (3)$$

Gross national saving should equal national investment, i.e.:

$$I = S. \qquad (4)$$

From (1), (2), (3) and (4) we can conclude that :

$$S = s\,\mathrm{Y} = k\,\Delta \mathrm{Y} = \Delta K = I. \qquad (5)$$

Or simply :

$$s\,\mathrm{Y} = k\,\Delta\mathrm{Y}. \qquad (6)$$

From (6) we find :

$$\frac{\Delta Y}{Y} = \frac{s}{k}. \qquad (7)$$

The formula (7) determined that the gross national product (GNP) growth rate was determined by the correlation between the national saving rate s and the capital/output coefficient *k*. More specifically, the growth rate of national income will be linked to a positive direct relationship with the saving rate. It is associated with an inverse or negative relationship with the capital/output coefficient; the rise in *k* will result the decrease of national income growth rate.

Therefore, for economic growth to happen, a certain percentage of GNP should be saved and invested. For example, if we assume that the capital/output coefficient in developing countries, equals 3 and the total saving rate is 6% of income, according to the equation (7), this country can grow at an annual rate of 2%. Now if the saving rate increased from 6% to 15% by increasing taxes or decreasing public consumption, the growth of national income can increase from 2% to 5%, because :

$$\frac{\Delta\mathrm{Y}}{\mathrm{Y}} = \frac{s}{k} = \frac{15\%}{3} = 5\%$$

A country that is able to save from 15% to 20% of its national income can achieve growth faster than those less-saving countries. The dilemma behind growth and economic development remains simply in the event of an increase in saving and national investment. The main obstacle to development according to this model is the relatively low level of new capital in most poor countries. If the state wants to grow at an average rate of 7% per annum, and can not save or invest at 21% of the national income (assuming the coefficient capital /output equals 3), but can only save 15% ; it must fill this saving gap by 6%, through any of the foreign aid or private foreign investment.

It is clear from the presentation of the Harrod-Domar model that it gives central importance to the saving rate as a determinant of economic growth, since it is difficult to influence the growth rate of the population and the capital factor significantly, especially in the short run. Hence, it is clear that the saving rate is the basic, or only, variable on which we must rely so much because it is the magnitude of this rate in which we can influence by increasing it, as national saving can be increased in several ways.

1.2.3. Saving in solow model (Mustafa Ben Saha, 2011)

This model is an extension of the Harrod-Domar model, focusing jointly on the importance of savings and investment as a key determinant of the process of capitalist accumulation, and hence economic growth. According to the Solow growth model, improving the savings rate encourages investment, which is a prerequisite for reaching a high growth rate (Ahmed Zejly, 2010). However, Solow adds two other elements of production to his model, namely labour and technological level. According to this model, growth in GDP is the result of one or more of the following factors:

- ✓ A quantitative or qualitative increase in the labour component through population growth and/or education;
- ✓ An increase in the capital stock through saving and investment;
- ✓ An improvement in the technological level.

1.2.4. Saving in the golden growth model of Phillips

In this model, Phillips has been interested in studying the relationship between consumption and capital accumulation or -saving- because it increases national income. It was felt that increased accumulation would lead to a reduction in current consumption. Since the increase in saving, which leads to increase investment and income, is at the expense of current consumption, at a later stage the law of diminishing return enters into force, implying that the increase in the capital required generating an increase in income may be greater than the increase in per capita income, which prevents individual consumption increase. The golden growth model of Phillips differs

from the Harrod-Domar model's in the following (Mohamed Abd El Ghaffar, 1997):

- ✓ The model depends on the flexibility of the prices of the production elements, rather than the stability of those prices;
- ✓ The model relies on an independent investment function, i.e. the model neglects the impact of future regulators' expectations on investment and income;
- ✓ The model is based on the idea of production functions, and assumes that the accumulation rate depends on the capital factor and the growth rate of both the volume and productivity of the labour element;
- ✓ The annual growth rate should be equivalent to the rate of return on capital, or the society should invest a size equal to the total net profits it has achieved, to increase the community capital, thereby maximizing the volume of consumption.

The golden model of growth is in line with the Harrod-Domar model, relying on the idea of balanced growth of the new Keynesians, and on imposing the neutrality of technological progress. The contemporary economic theory of development has reaffirmed the importance of saving and investment, considering that the asset is the quantity and the mix of saving and investment, and the foreign aid that is necessary, so that developing countries can move towards the long road of economic growth that followed by developed countries (Fares Rashid al-Bayati, 2008). Most economists assert that most of the countries whose societies have enjoyed a high level of national income saving and high growth rates have achieved high economic growth rates, including Japan, South Korea and Taiwan (Khaled Abdulrahman Al-Bassam, 2005). Moreover, the economic and social take-off date in European countries and 'states of Miracles' in Asia and America were possible, because it was preceded by a significant accumulation of saving contributed to the financing of development (Georges A. Soglohoun, 2010).

National saving is also one of the most important characteristics of the economic system in the United States of America (Ammar al-Sayed Abd El Baset, 2011), and the practical facts have demonstrated

the positive correlation between the rapid growth of the national economy and the accumulation of capital and saving. According to Levine (2004), the acceleration of economic growth is determined by several fields, the first of which is through the saving mobilization for productive investment (Development Bridge, 2009).

2- LITERATURE REVIEW

The literature consulted from research and periodicals to identify previous relevant efforts and studies, and these studies have addressed the subject of research in various aspects, including the following:

- ***The study of (Tarek Ben Khelif, 2016), titled*** 'The Impact of domestic saving on economic growth -an econometric study of the situation of Algeria during the period 1985-2012'. The study tried to clarify the role of saving in economic growth based on economic theory, by estimating the impact of real domestic saving on GDP per capita in the national economy during the period from 1985 to 2012. The results of the study showed a causal relationship moving from the saving rate to per capita output; this relationship was in line with economic theory. The results also confirmed the long-run relationship between the per capita output and the domestic saving rate.
- ***The study of (Kebir Mouloud, 2016), titled*** 'Saving and its role in economic growth –an econometric analytical study in Algeria compared to some Arab countries'. The study aimed to highlight the overlap and the reciprocal effect between domestic saving and economic growth in Algeria compared to some Arab countries during the period (1970-2012). The results showed causality in two ways; between the domestic saving rate and economic growth in the sample of countries, as well as a long-run relationship between the domestic saving rate and economic growth.
- ***The study of (Fathi Ahmed Ammi Adam, 2015), titled*** 'The Impact of domestic saving on economic growth in Sudan, 1990-2013'. The study aimed to know the relationship between domestic saving and economic growth in Sudan. It used the

econometric analysis methodology. One of the main findings of the study is that the relationship between economic growth and domestic saving in Sudan is reverse and contrary to the economic theory.

- ***The study of (Dhanuya jagadeesh,2015), titled*** 'the impact of savings in economic growth: an empirical study based on Botswana'. The purpose of this paper is to investigate the role of savings in Economic growth in Botswana. Botswana is one of the most successful resource-rich countries in the world. The study applied Harrod –Domar growth model on the Economy of Botswana. In addition, this study based on Auto Regressive Distributed Lagged (ARDL) model by Pesaran, Shin and Smith (1999) to check the existence of a long run relationship between Gross Domestic Product and Gross Domestic savings in Botswana. It further used DOLS approach in order to identify dynamic long run co integration between GDP and its independent variables. It also tested the stationarity and the co integration of Botswana's time series data for the period of 1980 to 2013. The test found out that there is a significant relationship between savings and economic growth, and the study supported Harrod Domar growth Model. Finally, policies are suggested to accelerate economic growth in the country.
- ***The study of (Chor Foon Tang & BeeWah Tan, 2014) titled*** 'The relationship between saving and economic growth in Pakistan'. The study aimed at researching the relationship between saving and economic growth in Pakistan during the period (1971-2011), using the Cointegration test and Granger Causality test between the two studied variables in Pakistan. The results indicate a long-run correlation between saving and economic growth, as well as the fact that domestic saving had a positive impact on short and long-run economic growth, and therefore saving is a catalyst for economic growth. As the results of causality test indicate, the growth of saving can be an effective catalyst for economic growth in Pakistan.
- ***The study of (Bankole & Fatai, 2013) titled*** 'The relationship between domestic saving and economic growth in Nigeria

during the period 1980-2010'. The researchers used the Engle-Granger Cointegration Test and Granger Causality to analyze the relationship between domestic saving and economic growth in Nigeria. The results of the study showed that causality is moving from saving to economic growth in Nigeria, so the researchers accept the Solo Hypothesis that saving precede economic growth, but reject Keynesian theory that economic growth leads to higher saving. In addition, the study recommended that governments and policy makers should use policies that accelerate domestic saving seeking to increase economic growth.

- ***The study of (G. M. Sajid and Mudasssira Sarfaz, 2008) titled*** 'The causal relationship between saving and economic growth in Pakistan'. The study used the Johansen Cointegration test to confirm the long-run relationship, and the Granger Causality between the two variables in Pakistan. The results indicated that there is a double trend of causality in the long term between saving and economic growth, while there is only one trend in the short run of saving towards economic growth. Thus, the results have shown the validity of the school of Capital defenders, which considers that the causal trend is from saving towards economic growth; the Keynesian school also, which considers the causal trend to be from economic growth towards saving.
- ***The study of (Emmanuel Anoruo & Yusuf Ahmed, 2001) titled*** 'The causal relationship between domestic saving and economic growth using seven African countries'. The study used Cointegration test and estimation using the Error Correction Model. The results indicated a long-run relationship between economic growth and the growth rate of saving, while the results of causality test indicate a contradiction with traditional theories, as economic growth causes domestic saving for most countries.

It has been observed in the economic literature on this topic in general and for a long time, that countries with high saving rates tend

to achieve higher growth rates; these results correspond to the traditional growth model (Solow, 1956), and new growth models for (Romer, 1987) and others. Therefore, countries with high saving rates for a long time tend to achieve substantial and sustainable economic growth; for example, the experience of developing countries in East Asia over the past decades .

The reason behind choosing this topic is the fact that research on this issue has been very limited for Algeria. In this case, it remains important for Algeria to appreciate the kind of relationship between domestic saving and economic growth, and such a study can help in the development of appropriate economic policies in Algeria.

3- DATA AND EMPIRICAL MODEL

In this part of the study, we aim to reveal the existence of a cointegration relationship between the two study variables, both domestic saving and economic growth in Algeria, where we will use an annual data series spanning from 1980 to 2018 and it is taken from the World Bank database. The study includes the stationarity examination of time series through the application of the Augmented Dickey–Fuller test (ADF) and the Phillips-Perron test (PP). Also, presenting the model, detecting a cointegration relationship, and estimating the short and long run relationship using (ARDL) Bounds Test Approach. To this end, we will follow the next steps to apply the (ARDL) model as follows:

- Unit root tests;
- Test the optimal lag length;
- Estimation of the model using (ARDL);
- Bounds test;
- Estimation of short and long-run parameters and error correction parameter;
- Diagnostic tests include the following:
  - Test the autocorrelation of the residuals using Breusch–Godfrey Lagrange multiplier test (BGLM) ;
  - Test the autoregressive conditional heteroskedasticity (ARCH-LM) test;

- Test the Normality of Residuals (Jarque-Bera test) ;
- Test the Regression Equation Specification Error (RESET) test;
- Test the cumulative sum of recursive residuals (CUSUM);
- Test the cumulative sum of squares of recursive residual (CUSUM SQ).

This study is based on the use of the Auto Distributed Lag model (ARDL) developed by Pesaran (Pesaran, 1997) and (Pesaran et al, 2001). the reason why this model is preferred over other well-known cointegration models such as (Johansen, 1988), or the two-step test method put by (Engle and Granger, 1987) to the problem of uncertainty, which usually appears on the characteristics and stationarity of time series, so using pesaran and Pesaran et al to the the bound test is the best option because this test does not require that the time series be integrated from the first order, usually symbolized by I(1). Moreover, Pesaran and Pesaran et al have better characteristics in the case of short time series than other usual methods. (Kremers et al. 1992) noted that, in the case of a small sample size, it is difficult to have a cointegration of non-stationary variables, and that the stationarity of time series leads to meaningless and biased regression parameters. The ARDL model enables us to separate short-term and long-term effects, as we can determine the cointegration relationship of the dependent variable and the independent variables in the long and short term in the same equation, as well as the extent to which each of the independent variables affect the dependent one. Also in this methodology, we can estimate the parameters of the independent variables in the short and long term, and its estimated parameters are more consistent.

The model examines the impact of domestic saving on economic growth, and it can be expressed in the following equation:

$$GDP = f\left(SAV\right) \qquad (*)$$

Where the variable GDP denotes the gross domestic product and SAV denotes the domestic saving.

By setting the target equation (equation (*)) in the form of the Autoregressive Distributed Lag model (ARDL), we get the following equation:

$$\Delta GDP_t = a_0 + \sum_{i=1}^{p} a_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{q} a_{2i} \Delta SAV_{t-i} + b_1 GDP_{t-1} + b_2 SAV_{t-1} + u_t \qquad (**)$$

Where Δ: first difference operator ; a_0 : constant ; a_1 and a_2 : short term effects ; b_1 and b_2 : long term dynamics of the model ; u_t : error term (gaussian white noise with zero mean).

The equation contains two areas:

$a_0 + b_1 GDP_{t-1} + b_2 SAV_{t-1}$: represents the long-run area.

$\sum_{i=1}^{p} a_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{q} a_{2i} \Delta SAV_{t-i}$: represents the short-run area.

To test the hypothesis of the absence of a cointegration relationship between the dependent variable and the variables interpreted in equation (**), we calculate the F statistic through the (Wald test) for the null hypothesis: $b_1 = b_2 = 0$

Versus the alternative hypothesis of a cointegration relationship between the levels of the model variables, where the alternative hypothesis provides: $b_1 \neq b_2 \neq 0$

If the calculated F statistic value is greater than the top limit of the critical value, we reject the null hypothesis (i.e. there is a cointegration relationship between the two variables), and here we use (ARDL) method to estimate the Error Correction Model (ECM). If the calculated F statistic value is less than the minimum, the null hypothesis is accepted.

4- RESULTS AND DISCUSSION

4.1- The Unit root test procedure

Although the bound test method is applicable regardless of whether the variables are integrated of different order (integrated of order zero I(0) and integrated of order one I(1)), or a combination between them, it remains necessary to make sure that there is no variable integrated of order two I(2). To verify the degree of

integration of the variables we use the Augmented Dickey-Fuller test (ADF) as well as the Phillips-Perron test (PP). The results are shown in table (1).

Table 1: Results of unit root tests using the ADF test and PP test

		UNIT ROOT TEST TABLE (PP)		UNIT ROOT TEST TABLE (ADF)	
		At Level			
		GDP	**SAV**	**GDP**	**SAV**
With Constant	t-Statistic	3.1187	0.8190	2.9521	0.5533
	Prob.	***1.0000***	***0.9931***	***1.0000***	***0.9864***
		n0	n0	n0	n0
With Constant & Trend	t-Statistic	-0.8028	-1.7859	-0.9621	-1.9286
	Prob.	***0.9564***	***0.6918***	***0.9375***	***0.6201***
		n0	n0	n0	n0
Without Constant & Trend	t-Statistic	5.0522	2.2985	5.4596	1.9174
	Prob.	***1.0000***	***0.9938***	***1.0000***	***0.9852***
		n0	n0	n0	n0
		At First Difference			
		d(GDP)	**d(SAV)**	**d(GDP)**	**d(SAV)**
With Constant	t-Statistic	-4.1710	-5.1827	-4.1971	-5.2837
	Prob.	***0.0023***	***0.0001***	***0.0022***	***0.0001***
		***	***	***	***
With Constant & Trend	t-Statistic	-5.9146	-5.4885	-5.4992	-5.4734
	Prob.	***0.0001***	***0.0004***	***0.0003***	***0.0004***
		***	***	***	***
Without Constant & Trend	t-Statistic	-2.7920	-4.7043	-2.9255	-4.7097
	Prob.	***0.0065***	***0.0000***	***0.0046***	***0.0000***
		***	***	***	***

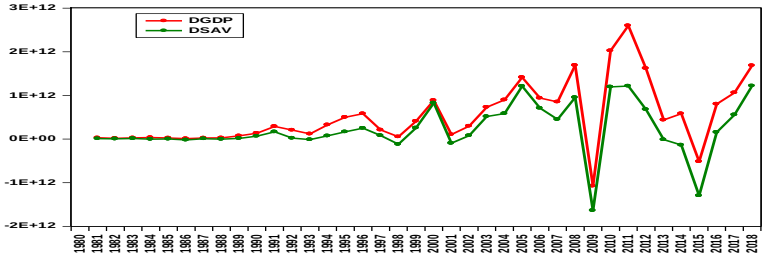
Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%, and (no) Not Significant

Source: EViews9 program output

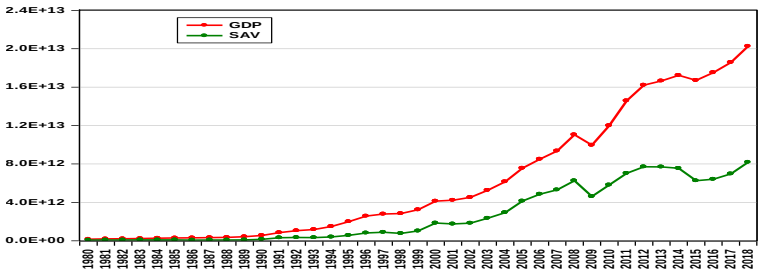
Table (1) shows that the SAV and GDP variables are stationary in the first difference, i.e. they have no order of integration greater than one. Therefore, we can use the bound test of cointegration technique to look at the extent of a long-run relationship between the two studied variables. Through the graphical representation of time series, we can enhance the results achieved earlier. As Fig 1 shows, the model variables are not stationary at the level. However, by making the first difference they fluctuate around a fixed arithmetic mean that there is

no relationship to time. Thus, they take a horizontal form parallel to the horizontal axis, which shows that they are devoid of a unit root.

Fig 1: Stationary of time series in the first difference



Time series non-stationary at the level



Source : EViews10 program output (based on World Bank data)

4.2- Determination of the optimal lags and estimation of the ARDL model

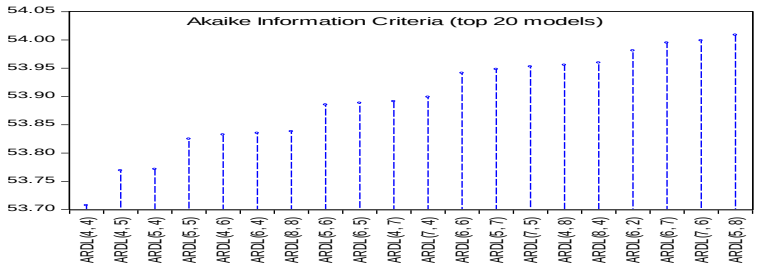
After conducting the tribal tests, and ensuring that the time series are not integrated to order 2, the model can be estimated. However, before that, the optimal lags p , q should be determined, where the ARDL method is very sensitive to the lag number of dependent variable. For this purpose, we will use the Akaike Information Criterion (AIC) (the length of the lag is chosen by the low value of this criterion). Then the model was estimated using the Eviews9 program and the maximum number of lags was determined automatically (8 times). According to the AIC criterion the results indicate that the optimal model is the ARDL (4,4) model, where it was chosen among 72 models evaluated. (Table 2, Fig 2).

Table 2 : The ARDL (4.4) model

Dependent Variable: GDP				
Sample (adjusted): 1984 2018				
Included observations: 35 after adjustments				
Maximum dependent lags: 8 (Automatic selection)				
Dynamic regressors (8 lags, automatic): SAV				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	1.597747	0.159441	10.02093	0.0000
GDP(-2)	-1.123618	0.268052	-4.191793	0.0003
GDP(-3)	0.904700	0.231655	3.905383	0.0006
GDP(-4)	-0.504107	0.124165	-4.059975	0.0004
SAV	1.130708	0.029822	37.91549	0.0000
SAV(-1)	-1.729474	0.186557	-9.270498	0.0000
SAV(-2)	1.106836	0.287988	3.843340	0.0007
SAV(-3)	-0.739124	0.240880	-3.068436	0.0051
SAV(-4)	0.526557	0.139627	3.771166	0.0009
C	8.96E+10	3.12E+10	2.872565	0.0082
R-squared	0.999840	F-statistic		17403.90
Adjusted R-squared	0.999783	Prob(F-statistic)		0.000000
		Durbin-Watson stat		1.822013
*Note: p-values and any subsequent tests do not account for model selection.				

Source: EViews9 program output

Fig 2: AIC graphics values



Source : EViews9 program output

4.3- Cointegration testing using the bounds test approach

After estimating the parameters of the ARDL model (4,4), it is necessary to verify the possibility of a long-run equilibrium relationship, using the Bounds Test Approach (ARDL). Table 3 shows the test results, where the calculated f-statistic value is equal to (9,281)

and is greater than the upper limit value of the critical values in the model. Consequently, we reject the null hypothesis at the significance levels 1%, 5% and 10%, where there is a long-run equilibrium relationship between GDP and domestic saving in Algeria. Moreover, they are not moving away from each other in the long run, they move closely since there is a long-run stability between them.

Table 3 : results of the Bounds Test Approach

Sample: 1984 2018		
Test Statistic	Value	K
F-statistic	9.281524	1
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	4.04	4.78
5%	4.94	5.73
2.5%	5.77	6.68
1%	6.84	7.84

Source : EViews9 program output

4.4- Short and long run parameters estimation

After confirming the existence of a cointegration relationship, we will measure both the long-run and the short-run relationship. This phase includes acquiring the parameters estimations under the ARDL model, and we relied on the Akaike information criterion (AIC), where the estimated parameters appeared as follows:

Table 4 : Estimation results of the (ARDL-UECM) model

ARDL Cointegrating and Long Run Form				
Dependent Variable: GDP				
Selected Model: ARDL(4,4)				
Sample: 1980 2018				
Included observations: 35				
Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.723024	0.143267	5.046702	0.0000
D(GDP(-2))	-0.400594	0.151041	-2.652217	0.0137
D(GDP(-3))	0.504107	0.124165	4.059975	0.0004
D(SAV)	1.130708	0.029822	37.915486	0.0000
D(SAV(-1))	-1.106836	0.287988	-3.843340	0.0007
D(SAV(-2))	0.739124	0.240880	3.068436	0.0051
D(SAV(-3))	-0.526557	0.139627	-3.771166	0.0009

CointEq(-1)	-0.125278	0.029955	-4.182148	0.0003
Cointeq = GDP - (2.3588*SAV + 714979891843.8713)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
SAV	2.358794	0.136041	17.338834	0.0000
C	714979891843.87	211664693297.53	3.377889	0.0024

Source: EViews9 program output

From the table (4) , the cointegration equation can be extracted as follows:

$$\Delta(GDP) = 0.7230 * \Delta(GDP(-1)) - 0.4005 * \Delta(GDP(-2)) + 0.5041 * \Delta(GDP(-3)) + 1.1307 * \Delta(SAV) - 1.1068 * \Delta(SAV(-1)) + 0.7391 * \Delta(SAV(-2)) - 0.5265 * \Delta(SAV(-3)) - 0.1252 * (GDP - (2.3587 * SAV(-1) + 714979891843.87))$$

So we have:

$$GDP = (7.15E+11) + 2.3588 * SAV$$
$$t\text{-}Statistic \quad (0.0024) \quad (0.0000)$$

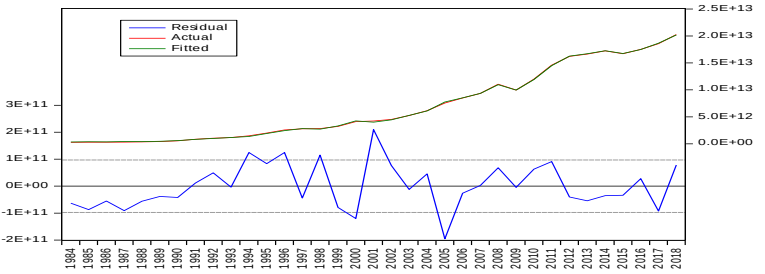
Through a long-run relationship, the extent to which the gross domestic product responds to a change in the domestic saving volume can be determined, as the results show that the relationship between the two variables (positive signal) is positive, and is highly statistically significant at 1%. What means the positive effect of domestic saving on growth economic in Algeria, which corresponds to the economic growth models mentioned earlier. Increasing domestic saving with one unit will be followed by an increase in GDP by 2.358 unit. The parameters estimations also came statistically significant at a level of 5%. We also note that short-run results are somewhat different from the long-run results, with the exception that the GDP is determined not only by domestic saving in the short period but also by the volume of the GDP in the previous period.

As shown in the light of the results of the unrestricted error correction model (ARDL-UECM) included in the previous table 4, the error correction term (CointEq (-1)) is negative and statistically significant, which means reference to the stable equilibrium situation, i.e. the necessary condition (be negative) and sufficient (to be significant) are achieved, and this is further evidence of a long-run equilibrium relationship between the estimated model variables.

The value of the error correction coefficient indicates that approximately 12.52% of the short-run imbalance can be corrected annually in order to return to the long-run equilibrium situation. On the other hand, the correction rate reflects a low adjustment velocity to revert to the equilibrium position after the impact of any shock in the model, as a result of the change in the determinants of product. It is also clear to us from the model that all the independent variables affecting the variable GDP affect it in its current and at different time delays, in addition to the constant, which is very much in line with reality; many economic phenomena do not directly respond to their determinants, but are the result of historical accumulations. The results also indicate that independent variables, all without exception, have statistical significance (according to the student's test: $|t_{calculated}| > t_{25,0.025}$ at level of 5% of significance, as well as the critical value $(prob < 0.05)$). It is worth noting here that we can use the student test because the errors are normally distributed according to the result of Jarque-Bera test. We also note that the overall model statistically significant at level of 5% of significance (according to the Fisher Test, that: $F_{calculated} = 17403.9$ (See the table (2)) greater than the critical value at 5% of significance which is equal to $F_{9,25,0.05} = 2,2821$ and $(prob < 0.05)$ so we reject the null hypothesis, which means that at least one of the regression coefficients is different from zero, and there is a relationship between the change in Gross domestic product (GDP) values and the independent variables in the composition of this model. The Adjusted R-squared $\overline{R}^2 = 0.99$ is considered to be very sufficient to interpret the model by 99%, and the value of Durbin-Watson(DW-Stat) is somewhat distant from the problem of first-order autocorrelation in the errors, but the use of the ARCH-LM test result is better in such a case as the result of the lagged variables in the formation of the model. The results (the good statistical significance of all the estimated model parameters, the creation of all critical probability values less than 0.05, and the determination coefficient ratio) denote the efficiency of the model in interpreting the changes of the dependent variable. This latter can be seen through the

representation of the estimated series (Fitted) and compared with its real data. We note in Fig (3), the semi-conformity between the curves of the real series and the estimated series.

Fig 3: The original series of GDP and its estimated series



Source : EViews9 program output

The following diagnostic tests will be performed for the estimated model.

5- DIAGNOSTIC TESTS

5.1- Test of the first-order autocorrelation of the residuals using The Breusch–Godfrey (BGLM) Test:

From table (5) we note that the critical probability for Fisher equals 59.28%, so we accept the null hypothesis H_0 at level of 5% of significance, which states that there is no first-order autocorrelation between the error terms, and to confirm this, we use the Lagrange Multiplier statistic (LM) where:

$LM = nR^2 = 0.423197 < \chi^2_{0.05}(1) = 3,841$. We note that n : number of observations, R^2: the coefficient of determination , $\chi^2_{0.05}$: chi-squared statistic. Therefore, we accept H_0 at level of 5% of significance.

Table (5): Results of the BGLM test of first-order utocorrelation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.293744	Prob. F(1,24)	0.5928
Obs*R-squared	0.423197	Prob. Chi-Square(1)	0.5153

Source: EViews9 program output

5.2-Test of the second -order autocorrelation of the residuals using The Breusch–Godfrey (BGLM) Test:

From table 6 we note that the critical probability for Fisher equals 74.16%, so we accept the H_0 hypothesis at level of 5% of significance, and to confirm that we conduct the test. We have LM statistic where: $LM = nR^2 = 0.8980 < \chi^2_{0.05}(2) = 5,99$. Therefore, we accept H_0 at level of 5% of significance, i.e. there is no second -order autocorrelation between the error terms.

Table 6 : Results of the BGLM test of second-order autocorrelation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.302856	Prob. F(2,23)	0.7416
Obs*R-squared	0.898085	Prob. Chi-Square(2)	0.6382

Source: EViews9 program output

5.3- Test of the autoregressive conditional heteroskedasticity (ARCH-LM) test:

The objective of this test is to find out if there is a correlation between the squares of the residuals, and this test depends on the Fisher or multiple Lagrange (χ^2 statistic) test. To test the first-order autocorrelation between the residuals squares we use the ARCH-LM test, where we get the results shown in table (7).

For the Fisher test, we have $F_{calculated} = 0.034108 < F_{1,32,0.05} = 4.149$ and we have the Lagrange Multiplier (LM):

$LM = nR^2 = 0.036201 < \chi^2_{0,05}(1) = 3,841$; and what supports the two previous results is the critical probability of both the Fisher test and the multiple of Lagrange test, where the first is equal to 85.46% and the second is 84.91%, which is greater than the level of 5% of significance, which entails the acceptance of H_0, i.e. the Conditional variance of the residuals is homogeneous, i.e. homoscedasticity.

Table (7): Results of the ARCH-LM test

Heteroskedasticity Test: ARCH			
F-statistic	0.034108	Prob. F(1,32)	0.8546
Obs*R-squared	0.036201	Prob. Chi-Square(1)	0.8491

Source : EViews9 program output

5.4- Test of the Normality of Residuals (Jarque-Bera test):

We can study the distribution of the Residuals, by testing the Normality of distribution, which based on the Jarque-bera statistic, the latter associated with the kurtosis coefficient (*K*) and the skewness coefficient (S), as they follow the $\chi^2_\alpha(2)$ distribution. The test form is as follows:

$$\begin{cases} H_0 : \sqrt{S} = K - 3 = 0 \\ H_1 : \sqrt{S} = K - 3 \neq 0 \end{cases}$$

H0: means the normality of distribution.

Jarque-Bera statistic is calculated as follow :

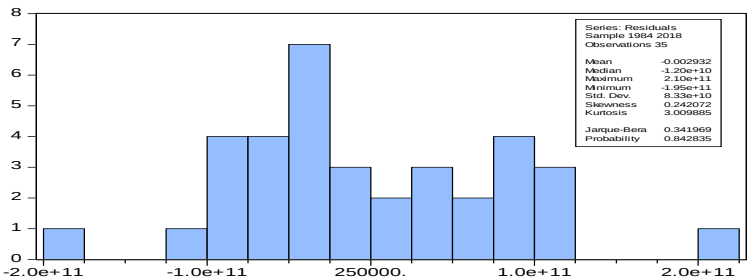
$J.B = n/6\left[S^2 + 1/4(K-3)^2\right]$; where n : sample size.

So :

$$J.B = \frac{35}{6}\left[0.242072^2 + \frac{1}{4}(3.009885-3)^2\right] = 0.34 < \chi^2_{0.05}(2) = 5.99$$

Since the JB statistic is equal to 0.34 and is less than the value $\chi^2_{0.05}(2) = 5.99$, we cannot reject the null hypothesis that the residuals are normally distributed. Also as an alternative procedure, since the probability value (p-value) of the JB statistic equal to 0.84 is greater than the level of 5% of significance, so we cannot reject the null hypothesis, and from it we accept the hypothesis that the residuals are normally distributed at level of 5% of significance. Fig 4

Fig 4: Normality Test of the Residuals



Source : EViews9 program output

We now describe a more powerful test which is also based on skewness and kurtosis, this test is called the D'Agostino-Pearson test and it has a chi-square distribution with 2 degrees of freedom. The test is shown in table (8), From this table we see that $p-value = 0.7068 > \alpha = 0.05$, so we conclude that there are no grounds to reject the null hypothesis where the residues are normally distributed.

Table 8: results of the D'Agostino & Pearson test

D'Agostino & Pearson test	
K2	0,6941
P value	0,7068
Passed normality test (alpha=0.05)?	Yes

Source: GraphPad Prism 8 program output.

Test of the Regression Equation Specification Error (RESET) test:

Using the Eviews9 program we get the results shown in table 9. We note that the Fisher statistic equals to $F = 0.9389$ and the probability value P-value equals to 0.3422; and therefore, we accept the null hypothesis that there are no specification errors at level of 5% of significance, i.e. the RESET statistic indicates the validity of the formula for the function used in the model.

Table 9: Results of the RESET test

Ramsey RESET Test			
Equation: UNTITLED			
Specification: GDP GDP(-1) GDP(-2) GDP(-3) GDP(-4) SAV SAV(-1) SAV(-2) SAV(-3) SAV(-4) C			
Omitted Variables: Squares of fitted values			
	Value	Df	Probability
t-statistic	0.968978	24	0.3422
F-statistic	0.938919	(1, 24)	0.3422

Source: EViews9 program output

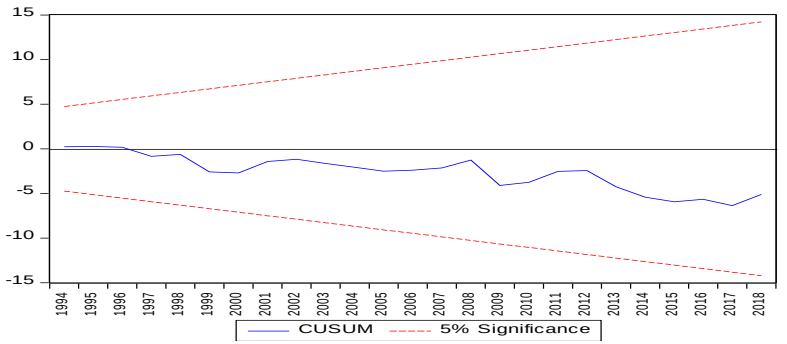
5.6- The Stability Test of the ARDL model parameters

To ensure that the data used in this study is free of any structural changes. Moreover, to ascertain the stability and compatibility of long-run parameters with the short-run parameters, we perform the Test of the cumulative sum of recursive residuals (CUSUM) test, as

well as the cumulative sum of squares of recursive residual (CUSUM SQ) test. These two tests are one of the most important tests in this area because they illustrate two important things: demonstrating the existence of any structural change in data, and the stability and compatibility of long-run parameters with short-run parameters. The structural stability of the estimated coefficients of the error correction formula for the ARDL model is achieved if the graph of the CUSUM and CUSUM SQ tests within the critical boundary falls at level of 5% of significance. The results of the previous two tests showed the following:

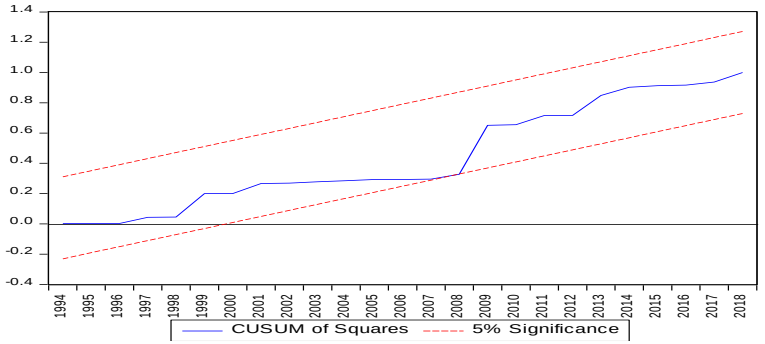
The test of the cumulative sum of recursive residuals (CUSUM) in Fig. (5) shows that the form line is within the critical area boundary, indicating that the model is stable at level of 5% of significance. The same is true for the test of cumulative sum of squares of recursive residual (CUSUM SQ) shown in Fig. 6, except for the value in 2007 in which the cumulative sum of squares of recursive residual is 0.30, but remains very close to the minimum area of confidence at 5%, where at point 2007 is equal to 0.29. In general, it is clear from the tests that there is stability and consistency in the model between long-run results and short-run results. Thus, the estimators are constant and stable over time, meaning there is no more than one equation. Based on the foregoing, it can be said that the ARDL model that we propose is a good model and has no econometric problems.

Fig 5: CUSUM test



Source: EViews10 program output

Fig 6: CUSUM of Squares test



Source: EViews10 program output

The most important feature of this study is the taking into account the dynamic characteristics of domestic savings and economic growth in Algeria, as it is keeping pace with the development of econometric modeling using time series data. the contribution of the present study is reflected in the presentation of an experimental guide on the correlation between savings and economic growth in Algeria, where the study showed that there is a long-term relationship between the rate of domestic savings and economic growth in Algeria, It has been shown that the increase of domestic savings with one unit will be followed by an increase in GDP by 2.358 unit. In addition, (within the limits of researchers' knowledge) savings have not been prompted by the attention required in most practical studies, and even studies on the subject of savings are few, if not rare, in Algeria, and in general they have dealt with savings only at the family sector level.

CONCLUSION

The special attention of this study was to examine the impact of domestic saving on economic growth in Algeria. The results of the study showed a long-run equilibrium relationship between the two variables, thereby the validity of the basic hypothesis of the research; that is, the level of domestic saving is equally important and positive to achieve high growth rates in Algeria. This conclusion means that if a high rate of saving is achieved in Algeria, policies should be directed

towards achieving high rates of investment, leading to higher economic growth rates in the end.

On the basis of the foregoing, it is necessary to combine efforts towards the development of saving in Algeria, which will remain the focus of the economic policy and an alternative to the consideration of economic problems, especially with regard to ensuring adequate financing of development investments. as well as to avoid the so-called domestic resource gap, which must be of great importance and study in Algeria, especially at this stage where the Algerian economy suffers from a lack of financial resources and the erosion of reserves of foreign exchange. The development of saving is vital and very urgent, as it is the engine of any development process in the country. In all stages of economic development, it is the necessary condition for investment. By increasing its size, we will further improve the conditions of economic development and push for appropriate and acceptable rates of growth.

In this context, we can suggest the following recommendations that can improve the impact of domestic savings (family savings, government savings and business savings) on Algeria's economic growth by better mobilizing these savings :

- At the family sector level, there is a need to increase per capita national income by reducing the phenomenon of poverty and unemployment, taking into account the religious motivation of citizens by not forcing them to deal with interest rate, working to rationalize consumption, strengthening bank savings awareness, facing hoarding and encouraging savings through zakat, spreading insurance savings awareness, promoting insurance savings awareness, encouraging further transfer of the savings of citizens working abroad, and ensuring political stability.
- At the business sector level, it is necessary to pay more attention to SMEs and to encourage long-term returns projects, which generate investmentable savings in the future, using tax incentives.
- At the government sector level, we recommend that work should be done to increase revenues of the public business sector,

support tax energy in the national economy, rationalize public spending, develop the foreign trade sector and combat financial corruption.

- As for the banking system,, researchers believe that it is necessary to implement incentive systems and provide a rewarding return on savings, combat inflation, establish the concept of safety and trust in the banking system, implement a strategy for developing the banking service, create new savings vessels in the banking system, and especially encouraging the establishment of Islamic banks, and introducing new banking products, developing banking marketing and developing the stock market.

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