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Predicting the Size of Shadow Economy in Algeria (2016-2019)

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Abstract:

This paper aims anticipate the size of shadow economy in Algeria from 2016 to 2019.The results of the study are based on two methodologies: first, establishing the relationship between shadow economy and economic growth over the period 1992-2015; and second checking the power of model to predict size of shadow economy from 2016 to 2019. The findings suggest that there is a negative significant impact of shadow economy on economic growth, and the size of shadow economy is nearly 24-26 percent for the specified period.

Keywords: Shadow Economy; Economic Growth; Regression; Predicting.
JEL Classification Codes: C53, E26, H26.

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1. Introduction

Shadow economy (SE) represents a complex phenomenon, which is having undoubtedly many negative sides and undesirable implications upon economy and society. Government loses a large portion of their incomes through tax invasion, tax avoidance, and inefficient fiscal authorities or in sum shadow economy, which can contributes towards promoting sustainable development. The literature review suggests that increasing in the shadow economy leads to decrease in economic growth. Further, governments have attempts to define almost the size of shadow economy on economic growth to overcoming it by its integration in formal economy.

The growing concern is reflected in many attempts by different economists to measure the size of shadow economy. In Algeria, as well as the case of developing countries, when the shadow economy is present and it is largely absorbs important sources of GDP. The estimate of the size of Algerian shadow economy varies vastly from researcher to another on the base of the methods used.

Research Problem

Based on the above, the following problem has been formulated:

What is the impact of shadow economy on economic growth in Algeria over the period 1992-2015? And what is the size of shadow economy measured as percentage of official GDP for the period 2016-2019?

Research Hypotheses

In the light of the problem, the following hypothesis was put forward:

- There is a significant negative impact of shadow economy on economic growth in Algeria over the period 1992 - 2015.
- The model is qualified for forecasting, so we could anticipate size of shadow economy for the period 2016-2019.

Research Objectives

Through this research paper, we seek to achieve a set of goals summarized below:

- To contribute to the general body of economic literature on shadow economy;
- To investigate the significant relationship between shadow economy and economic growth in Algeria;
- To predict the values of shadow economy over the period 2016-2019.

Research Structure

The study covers both theoretical and applied sides. The first one develops theoretical literature undertaken the interactions between variables selected. The second outlines the empirical study using the regression approach for the period from 1992 to 2015 and forecasting shadow economy for the period 2016-2019.

2. Relationship between shadow economy and economic growth

2.1 Shadow Economy Approaches and Shapes

The shadow economy is often referred to also as a grey market, or an informal economy. It should be distinguished from the black economy which means naturally illegal activities such as crime or producing and distributing drugs. OECD Glossary of Statistical Terms consists of activities that are productive in an economic sense and quite legal (provided certain standards or regulations are complied with, but which are deliberately concealed from public authorities for the following reasons (Schneider F. , 2005):

- To avoid the payment of income, value added or other taxes;
- To avoid payment of social security contributions;
- To avoid meeting certain legal standards such as minimum wages, maximum hours, safety or health standards, etc;
- To avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

Schneider (2018) identifies four key causes of the shadow economy (Schneider, 2018):

- High tax burden;
- Lack of guilty conscience: Shadow economy is considered to be normal usually if there is low quality of state institutions and benefits;
- High spread of cash payments;
- Low risk of detection: It depends on effectiveness of control and penalties.

Over the years, the debate on the large and heterogeneous informal economy has crystallized into four dominant schools of thought regarding its nature and composition, as follows (Chen, 2012):

- The Dualist school sees the informal sector of the economy as comprising marginal activities distinct from and not related to the formal sector that provide income for the poor and a safety net in times of crisis (Hart 1973; ILO 1972; Sethuraman 1976; Tokman 1978).
- The Structuralism school sees the informal economy as subordinated economic units (micro-enterprises) and workers that serve to reduce input and labor costs and, thereby, increase the competitiveness of large capitalist firms (Moser 1978; Castells and Portes 1989).
- The Legalist school sees the informal sector as comprised of "plucky" micro-entrepreneurs who choose to operate informally in order to avoid the costs, time and effort of formal registration and who need property rights to convert their assets into legally recognized assets (De Soto 1989, 2000).
- The Voluntarism school also focuses on informal entrepreneurs who deliberately seek to avoid regulations and taxation but, unlike the legalist school, does not blame the cumbersome registration procedures.

2.2 Literature Review: relationship between shadow economy and economic growth

Many empirical studies have found the economic growth as pivot subjected to different explanatory variables like studies done by Ravallion & Chen (1997), Gupta & all (1998), White & Anderson (2001), Dollar & Kraay (2002), and Permia (2003) in which consider the shadow economy one of the important constraints of achieving considerable rates of economic growth (Rosser & al, 2003).

In this context, Blackburn & al (2012) investigated to what extent the financial development of a country is related to agents' decision to indulge in the informal economy due to their undeclared full incomes to avoid government taxes along with their business in the formal sector. They used a model of tax evasion and financial intermediation to analyze the relationship of informal market activity with credit market development. The result highlights the financial development is helpful to reduce the incidence of tax evasion only above a threshold level. If it is below a threshold level, the informal economy will exist and cause serious financial repression (Blackburn & al, 2012).

Haque (2013) has also examined the estimated size of the shadow economy in Bangladesh by developing the regression model with time-series variables for 1973–2008. The author also used Fully Modified Phillips-Hansen Estimate (FMOLS) to identify the long-run co-integration relationship. The main assumptions of Tanzi's approach is that mostly hidden transaction activities are carried out in the form of cash payments and a rise in the size of the shadow economy will also increase the demand for more currency. The findings show that in 1973, the shadow economy contributed to only 7% of nominal GDP. However, it increased to 62.75% of GDP in 2010. It creates an enormous burden on the economy, which, in turn, results in heavy tax distortion and flawed measurement of macroeconomic variables. The study's results regarding the long-run co-integrating relationship also support the Tanzi's original model (Haque, 2013).

Likewise, Osmani (2015) in his article on the shadow economy in Southeast European countries has associated this phenomenon with

the quality of national institutions, the effectiveness of legal systems, the rates of tax evasion and the levels of corruption. Moreover, he indicates that previous studies, among others by Schneider and Buehn, have shifted the scholarly discourse from a focus on the illegal economy to the notion of the shadow economy that comprises the production of goods and services not reported to public authorities. Osmani's findings show that in countries, such as Albania, the shadow economy sector has demonstrated continued growth the period between 2002 and 2012, despite macroeconomic stabilization (Osmani, 2015).

Similarly, in their study on the interrelations between the shadow economy, corruption and economic growth in the European Union, Sorin & al (2017) have found that in the period 2005-2014 a significant positive interrelationship between corruption levels and the shadow economy. Based on correlation and regression analyses, these authors have also found that both the levels of corruption and the size of the shadow economy have a significant negative impact on economic growth (Sorin & al, 2017).

As Friedrich Schneider & Andreas Buehn (2018) in their article on shadow economy indicated, no single widely accepted definition of the shadow economy exists. This could be due to the multiplicity of its possible causal variables; such as burdensome taxation and social security payments, low-quality institutions leading to corruption, high levels of regulatory costs, limited public sector services, and low levels of taxation compliance, insufficient and economic underdevelopment (Schneider, 2018).

While Alam & al (2019) their study took another curve in the analysis that measuring shadow economy is difficult, statistics shows the rate of employment creation by the informal sector in this region is higher than the rest of the world. But the GDP growth rate in this region is still emerging in the global economic competition that indicates its effectiveness in the South-Asian region. The study was carried out to identify the relationship between the informal economy and GDP growth rate in South-Asian developing countries. The target

population was economies of 8 South-Asian countries, which were also taken as the sample size. Data was collected from secondary sources and analyzed using multiple regression analysis. Results indicated that there is significant positive relationship between the shadow economy and GDP growth rate in South Asian developing countries. Therefore, it is necessary for the policy-makers and development practitioners in this region to give emphasis on the informal sector entrepreneurs to ensure constant economic growth and development (Alam, 2019).

Khong & al (2020) aimed to re-examine the impact of the informal economy on economic growth in Pakistan. This study first computed the informal economy through currency demand equation and then the adopted auto-regressor distributed lags (ARDL) technique for data analysis. The result indicated that 56% informal economy of gross domestic product (GDP) exists in Pakistan. The Wald *F*-test shows that the overall model is statistically significant because the value of this test (13.4) is more than the upper and lower bounds values. Whereas Engle-Granger causality test describes that the growth rate of real GDP causes the Granger to GDP at 5%. This study tried to solve these issues and give a new policy implication for policy-makers to control the informal economy and make sure that this sector will convert into a recorded or reported form (Khong & al, 2020).

In Algeria, as the case of all developing countries the shadow economy is present and pandemic. This growing concern is reflected in many attempts by economists to measure the size of the shadow economy and its causes.

Bounoua, Sebbah & Benikhlef (2014) analyzed the determinants and evolution of the shadow economy in Algeria from 1990 to 2009. The econometric analysis was based on a multiple indicator multiple causes' model, results from the study showed that public expenditure, inflation rate, unemployment rate and guaranteed national minimum wage are the main causes of the shadow economy; all the later variables are negatively related to the shadow economy

except the public expenditure. The estimated size of the shadow economy varies from 41.68% in 1991 to 46.43% in 2009 (Bounoua & al, 2014).

Quintano & Mazzocchi (2014) tried to approach the shadow economy by means of latent variable method and the structural equation model using the partial least squares to estimate the shadow economy in subsamples of the Mediterranean countries (23 country) during the period of 1995 to 2010. Results showed the Algerian shadow economy was unstable during this period the highest percentage was in 2008 46.4% of GDP and the lowest percentage was in 2002 32.4% of GDP with a mean of 39.47% over the study period (Quintino & al, 2014).

According to KORI (2018) in his paper titled: An estimation of informal economy in Algeria using MIMIC model Period 1970-2016 found that an increased budget deficit and urbanization rate are the driving forces of the shadow economy and they are positively related to it, and the results showed that the hidden part of economy in Algeria constitutes 47.4% of the official GDP in 2016 during the period of 1970 to 2016 (Kori, 2018).

From the brief presentation, we concluded a causal relationship by only comparison of shadow economy and economic growth using sets of data in different time periods in developing country, i.e., the use of panel data. Additionally, they have not elucidated the mechanism trough which shadow economy influences economic growth. Hence, the present study takes into account the critics mentioned before. It concerns only the national economy to explore relationship between shadow economies and tries to anticipate the values of shadow economy for the period 2016-2019.

3. Results and discussion

3.1Estimating approaches

The different estimating approaches can be categorized into direct, indirect and model approaches. The direct approaches include sample survey estimation, the estimation of tax audits based on survey

data, and audit measurements of undeclared taxable income to measure the size of the shadow economy. The Indirect approaches try to determine the size of shadow economy, by measuring the "traces" that it leaves in official statistics. They are often called "indicator" approaches and using mainly macroeconomic data. This strategy includes five categories: (a) Discrepancy between national expenditure and income statistics; (b) the discrepancy between the official and actual statistics of labor force; (c) The transaction approach; (d) The currency demand (or cash-deposit ratio) approach; (e) The physical input method (Dell'Anno, 2016).

The most of researchers widely accepted the cause academic that these approaches could be adjusted with specifies of the Algerian economy. On the base that the common hypothesis an increase in the one of the hidden element of shadow economy, provides strong incentive on economic growth.

3.2 Model specification and variables introduction

Since shadow economy affects the economic growth, so we have to use appropriate model the linear logarithm regression selected set of variables related to our local economy as follow:

The economic growth represents in the real gross domestic production (GDP).

The shadow economy includes all market-based legal goods and services production that are on purpose hidden from public authorities for the following reasons:

- Tax evasion.
- Avoiding the social insurance contribution payment.
- Refusing to observe specified legal measures such as minimum wage, maximum work hours and protective or health measures.
- Refusing to observe specified administrative methods and procedures such as completion of statistical questionnaires, escaping bureaucratic formalities etc.

The recent availability of data on the scope of shadow economy now makes such a study possible. In particular, Schneider & al (2010) estimate of the shadow economy as percentage of official GDP is used.

So, the model is formulated as follow:

Log (GDP) = α + β_1* log (GDP (-1)) + β_2 * log (SE) + e $_i$ …….. (1)

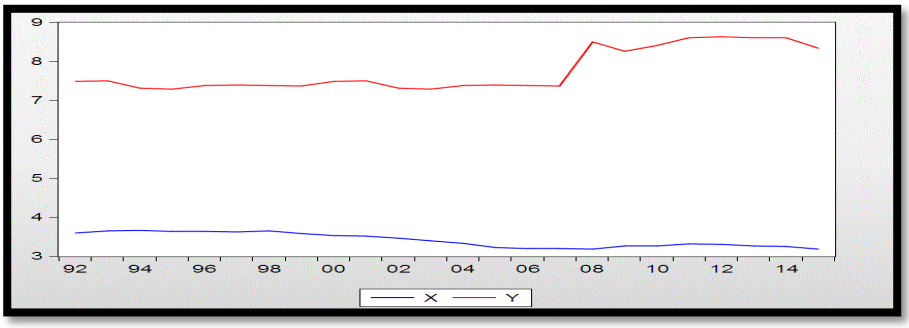
The formula (1) can be written as follow:

Y= α + β_1* Y (-1)) + β_2 * X+ e $_i$ …….. (2)

Where e_i : the term error.

The latest data are collected from global economy for 1992 to 2015. The graph below presents the evolution both of Y and X.

Fig.1. Evolution of sample data (1992-2015)



Source: Outputs, Eviews.10.

From the graph above, it illustrates that both variables have steady changes till 2007, whereas shadow economy is in decreasing, the GDP is in rising from 2008 to 2015.

3.3 Stationary test of variables

The ADF test was applied to data series and the results are reported in table (1). It shows that the variables are non-stationary in levels, but they become stationary after taking second difference for both variables. The results are significant at 1% or 5% or 10%.

Table 1. ADF Test Results

Variables	At Level	1st Difference	2nd Difference
log(GDP)	-0.45834	-3.76062	-7.03603
	(0.8825)	(0.0102)	(0.0000)
	-1.82227	-3.65470	-5.66636
	(0.6607)	(0.0486)	(0.0010)
	1.78870	-3.45367	-7.24365
	(0.9787)	(0.0015)	(0.0000)
log(SE)	-0.289	-3.2574	-7.1639
	(0.9123)	(0.0340)	(0.0000)
	-3.748	-2.0643	-6.9298
	(0.0451)	(0.5314)	(0.0001)
	-1.821	-2.6964	-7.24477
	(0.0538)	(0.0095)	(0.0000)

Note: the three cases are corresponding to the intercept, intercept and trend and none.

Source: Outputs, Eviews.10.

3. 4 Estimation of model

The results of estimation are illustrated in table (2) below:

Table 2. Model Estimation

Variables	coefficient	Std.Error	t-Statistic	Prob.
C	5.696224	1.663294	3.424664	0.0027
Y(-1))	0.755954	0.077137	9.800119	0.0000
X	-0.845903	0.250981	-3.370383	0.0030
R-Squared		0.967508		
Adjusted R-Squared		0.964259		
S.E of Regression		0.112877		
Durbin-Watson		1.804828		
J-Statistic		297.7706		
Prob (J-Statistic)		0.000000		

Source: Outputs, Eviews.10.

The formula defined as follow:

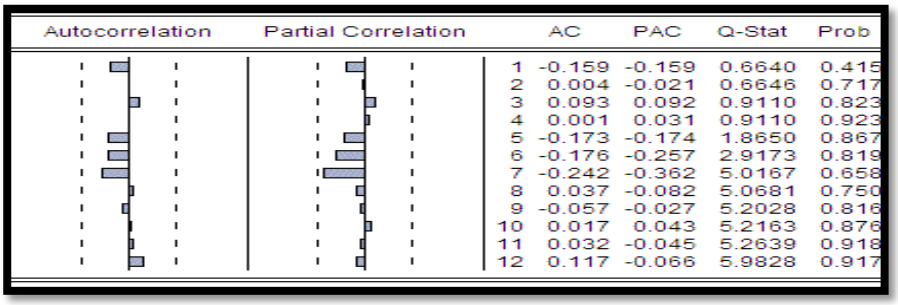
$$Y = 5.696224 + 0.755954^{*} Y(-1)) - 0.845903^{*} X$$

The main conclusion that can be drawn from this study is that shadow economy has a negative significant effect on economic growth. It conducts to reduce economic growth nearly 84.59 %.

- **Robustness check**

The diagnostic tests presented in figure (2) summarizes that there is no evidence of residual serial correlation probabilities are above 5% which means rejection of null hypothesis.

Fig.2. Residual Correlogram



Source: Outputs, Eviews.10.

Further, the diagnostic tests presented in the table (3) summarizes that there is no evidence of diagnostic problem with the model. Measuring the explanatory power of the model by their adjusted R squared proxy 96.42% of the variation in the GDP can be explained. The Breusch -Pagan-Godfrey heteroskedasticity test confirm that the errors are white noise and no serial correlation with p-value 32.74% and 20.55% respectively.

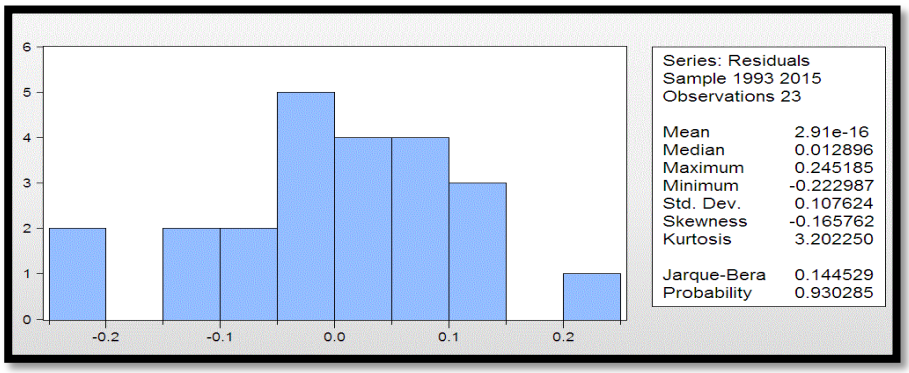
Table 3. LMT and ARCH Test

LMT Test		
F-Statistic = 1.188647	Prob.(2,18)	0.3274
ARCH Test		
F-Statistic =1.729645	Prob.(2,18)	0.2055

Source: Outputs, Eviews.10.

In addition, the normality test of residuals reaches 0.1445 and p- value proxy 0.9302 upper than 5%. This means the acceptance the null hypothesis that the residuals track the normal distribution.

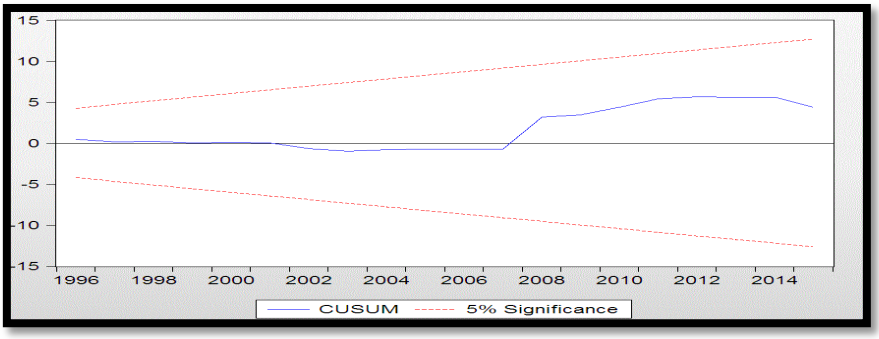
Fig .3. Normality Test



Source: Outputs, Eviews.10.

Moreover, The Ramsey RESET test indicates that the model is well specified and that there are no omitted variables in the model. The stability of the long-run and short-run model coefficients is checked through the cumulative sum (CUSUM).The results of the CUSUM presented in figure (3), it clarifies that the CUSUM of recursive residuals are within the critical bounds, meaning that all coefficients are stable over the sample period.

Fig.4. Recursive Test



Source: Outputs, Eviews.10.

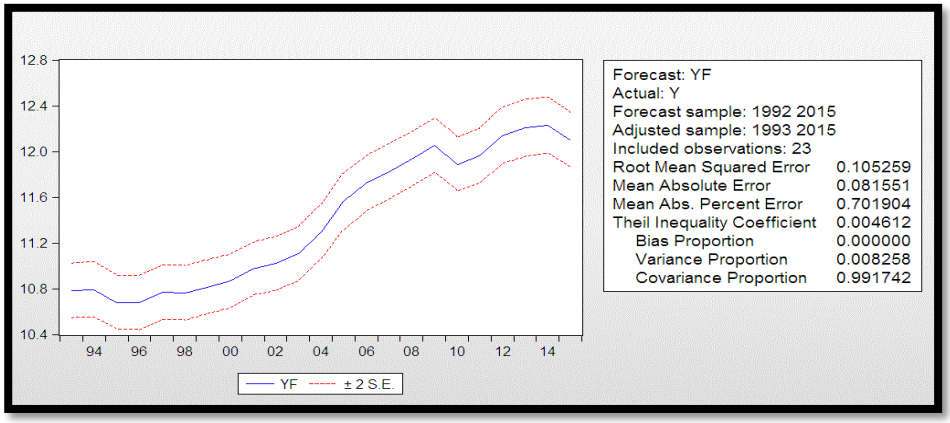
To conclude the whole of the running model is statistically accepted.

3.5 Predicting size of shadow economy for 2016-2019

a. Checking the power of model for forecasting

After checking that the model does not suffer of problems of autocorrelation in terms of errors, so could anticipating values of shadow economy for 20!6-2019. However, this could be not run after test of model's predictive power by forecasting (YF) from 1992-2015 as it appeared in the two following figures:

Fig .5. Forecasting (YF) for the period 1992-2015

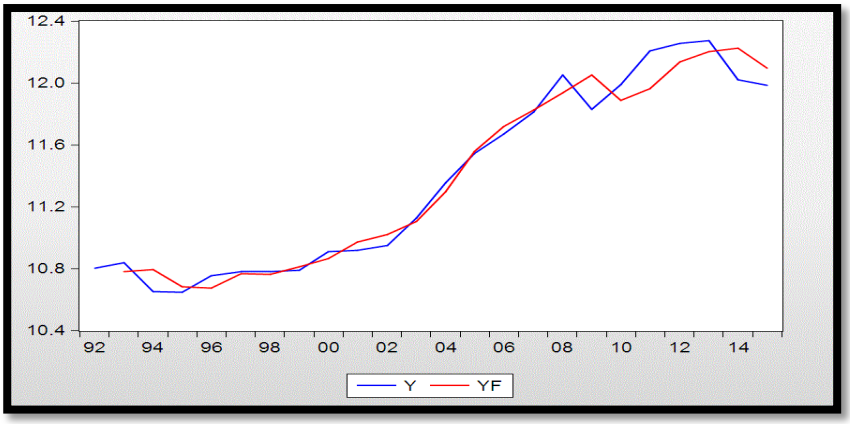


Source: Outputs, Eviews.10.

The most important criteria the root means squared error which should be lower than 50% and bias proportion also should be closer to zero. From the graph above both of criteria are respectively 0,106250 and 0,0000 which means that model estimated is perfect for predicting.

In addition, to confirm that conclusion we have plotted both series of (Y) and (YF) in graph below. The main remark that line blue line (Y) is too close to the red one, which means that (Y) values are almost the same of the estimated one (YF). So the model is perform to anticipate shadow economy values from 2016-2019.

Fig.6. Plot Data of (Y) and (YF)



Source: Outputs, Eviews.10.

b. Predicting shadow economy values 2016-2019

From above the estimated model fulfills all conditions, so the formula (2) rewrites as follow:

X = (5.696224 + 0.755954* Y(-1)) – Y / 0.845903……..(3)

Using the formula (3) results of forecasting values of size shadow economy (X) is shown in table below.

Table 4. Forecasting values of size shadow economy 2016-2019

year	GDP	Y= log(GDP)	X	e^X (%)
2016	170097	12,04412	3,204630	24,64
2017	175415	12,07491	3,222727	25,096
2018	171157	12,05014	3,279525	26,56
2019	170000	12,04355	3,265179	26,18

Source: Author.

From the table the size of shadow economy is still considerable, and it constitutes more than a quarter of the volume of GDP.

4. Conclusion

This paper provides fresh evidence to advance the debate on how measure size of shadow economy in Algeria from 2016 to 2019. We adopted methodology takes into account investigation the impact

of shadow economy on economic growth 1992-2015; and forecasting its size for the specified period.

The results give us answer for the central question and acceptance of null hypothesis, so the findings reveal that there is a negative significant effect of shadow economy on economic growth and the size of shadow economy ranges between 24 and 26 percent from 2016-2019.

The study emphasizes the huge size of shadow economy in Algeria. Fighting against shadow economy is not all about reinforcing laws and punishing offenders, but also about making the formal sector more attractive; and changes the social norms for paying taxes. Finally, to improve and sustainable high levels of economic growth can only be achieved through a successful links of corruption control and quality of institutions.

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