Estimating the informal economy in Algeria from 1980 to 2019: Currency Demand Approach

تقدير الاقتصاد غير الرسمي في الجزائر من 1980 إلى 2019: مقاربة الطلب على النقود

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Abstract:

This study aims to estimate the size and development of the informal economy using the currency demand approach from 1980 to 2019 in Algeria.

The investigation revealed many results such as the average Algerian informal economy over the study period is around 21% of the official GDP; the tax burden is an important determinant of IE; In the last twenty years, the tax policies applied by the Algerian government did not reduce the upward evolution of IE. Thus a re-evaluation of the tax system is needed.

Keywords:informal economy; currency demand approach;Taxes.

JELClassificationCodes: E26, E41,E62

ملخص:

تهدف هذه الدراسة الى تقدير حجم وتطور الاقتصاد غير الرسمي باستعمال مقاربة الطلب على النقود من 1980 إلى 2019 في الجزائر.

خلصت الدراسة الى مجموعة من النتائج من بينها متوسط حجم الاقتصاد غير الرسمي خلال فترة الدراسةبلغ 21% من الناتج الداخلي الخام الرسمي؛ العبأ الضريبي محدد مهم لحجم الاقتصاد غير الرسمي؛

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في العشرين سنة الماضية، السياسات الضريبية المطبقة من طرف الحكومة الجزائرية لم تقلل من حجم الاقتصاد غير الرسمي والذي استمر حجمه بالتزايد.وبالتالي حناك حاجة لإعادة تقييم النظام الضريبي.

كلمات مفتاحية: اقتصاد غير الرسمي، مقاربة الطلب على النقود؛ضرائب.

تصنيفات JEL: E26، E41، E62

1. INTRODUCTION

In the last half-decade, there is a growing literature devoted to studying the informal economy around the world(Adair P. , 2014; Bennihi & Bouriche, 2020; Hart, 1973; ILO, 1993; Schneider, 2002). Over this period scholars and researchers called it with several terms such as informal economy; shadow economy; underground economy and many others.

(De colin & Schneider, 2016)counted 44 adjectives and 10 nouns to describe this phenomenon and every term is related to a specific definition. In most cases, the definitions and concepts adopted depend on the chosen approach to estimate the informal economy by the author. To estimate the informal economy there are different estimating approaches, and they can be classified into three main categories first, direct approaches include sample survey estimation; the estimation of tax audits based on survey data; and audit measurements of unreported taxable revenue. (Wang, Lin, & Yu, 2006). Second, the Indirect approaches include (1) The inconsistency between the official and actual statistics of the labor force; (2) Discrepancy among national expenditure and income statistics; (3) The transaction approach; (4) The currency demand approach; (5) The physical input (e.g., electricity) approach (Dell'anno, 2003). This approach tries to try to determine the size of the informal economy, by measuring the “traces” left in official statistics. They are often called “indicator” approaches and using mainly macroeconomic data. Third, the model approach was first introduced by Frey &Hannan- Weckman in 1984. According to (Schneider & Buehn, 2018), there is no ideal method for estimating the informal economy, each approach has its pros and cons.

When measuring the size of the informal economy researchers considered a number of different causes; the most widely acknowledged and important cause in literature is the tax burden(Asplaire, 2014; Gilles,

1999; Tanzi, 1980). The commonly accepted hypothesis is that an increase in the tax burden provides a strong incentive to work in the informal and evade paying taxes. This reduces the government revenues making a gap in its returns thanks to evasion. The amount of this loss can be approximately calculated from the size of the informal economy.

To estimate the size of the informal economy in Algeria. This study adopts the definition of (Vorobyev, 2015)"informal economy represents all existing economic activities that don't seem to be properly registered by the government due to completely different reasons from simple mistakes to evasion or alternative prohibited activities. Among factors that force economic activities in the informal sector are taxes, government regulation, corruption…". Accordingly, the main concept of the informal economy in this paper refers mainly to unreported legal activities that involve monetary transactions.

As the case of most developing countries, Algeria has an important size of the informal economy, due to structural changes that Algeria went through since its independence. In addition to unbalanced economic strategies that depend almost entirely on oil revenues. Making the Algerian economy fragile to the oil price shocks. The failure of the official economy leads to the existence of the informal economy. However, there is a literature gap in the studies devoted to studying the Algerian informal economy, especially the estimation of its size and development in comparison to other countries. We will exhaustively discuss these studies in the next section of the paper.

The current study aims to estimate the informal economy using the currency demand approach in Algeria over the period from 1980 to 2019.

The paper is structured as follows, in the next section literature review, in section three methodology; in the last section the main estimation results are discussed and followed by the conclusion.

2. LITERATURE REVIEW

2.1 the currency demand approach

One of the popular and most used indirect monetary methods to

estimate the IE in literature is the Currency Demand Approach (CDA). It was first proposed by (Cagan, 1958), who used it to estimate the correlation between the demand for currency and the tax weight for the U.S. over the periods 1919 to 1955 (Schneider, 2004). And later (Gutmann, 1977)applied CDA to estimate the IE in the United States, procedures by examining the correlation between currency and demand deposits and without using any statistical. This approach fits with the monetarist's views since the main assumption of this approach is that all informal payments are made in cash for not to be detected. Consequently, a rise in the demand for the currency may indicate the growth of the IE. However, to measure the size of the U.S. informal economy, the author assumed that from 1937 to 1941 there was no informal economy; and this assumption was criticized by (Tanzi, 1980)leading to question the reliability of this method.

Furthermore,(Tanzi, 1983)developed this method and applied it to estimate the U.S. informal economy from 1929 to 1980. His estimation of the IE is based on two assumptions: first, the informal economy is a result of high taxes; Second, the currency is basically used to carry out informal transactions (Mehnaz & Qazi , 1995).

The regression equation proposed by (Tanzi, 1983), is the following:

$$\ln\left(\frac{C}{M_2}\right)_t = \beta_0 + \beta_1 \ln(1+TW)_t + \beta_2 \ln\left(\frac{WS}{y}\right)_t + \beta_3 lnR_t + \beta_4 \ln\left(\frac{y}{N}\right)_t + \varepsilon_t \quad (01) \qquad (01)$$

Where: ln (C/M_2) is the natural logarithm of currency in circulation outside

the banks to M2; TW is a weighted average tax rate; WS / Y is a percentage of wages and salaries to national income; R is the interest paid on savings deposits and Y / N is the per capita income.

The expected signs of $\beta_1; \beta_2; \beta_3 > 0$ *while* $\beta_4 < 0$.

To estimate the informal economy: first, the model is estimated twice, once in its current state and again imposing the tax burden is held at its lowest value. The difference between the two estimates represents the volume of illegal currency that circulates in the informal economy; second, multiplying this difference by the velocity assuming that the velocity in both formal and informal economy is the same yields the nominal

aggregates of the IE (Greending, Holder, & Stuart, 2009).

(Ahumada, Alvaredo, & Canavese, 2009)argued and proved that the assumption of equality between velocity in the formal and informal economy is invalid, except in one case when income velocity is equal to one. Thus the studies which found income velocity is not equal to one their results must be corrected.

Over the last four decades, the original equation has been modified and new variables were added (Schneider, 2006) and it has been applied worldwide. (Gilles, 1999)used it to estimate the size and trend of the IE and tax evasion in New Zealand over the period 1968 to 1994; (Hernandez , 2009)in the case of Peru from 1979 to 2005; (Asante, 2012)in the case of Ghana during the period 1990 to 2010. (Hassan & Schneider, 2016) in the Egyptian and (Gamal & Dahalan, 2015)in Saudi Arabicfor 1980 to 2010.

2.2 the existing estimates of the Algerian informal economy

Despite the growing debates in the last decades of the informal economy and how to estimate it, we find a relatively small number of studies in Algeria who tried to measure the size and evolution of this phenomenon. The existing studies used a direct approach(Adair & Bellache, 2008; Smaili, 2019) and indirect approach(Boudlal, 2012; Bounoua, sebbah, & Benikhlef, 2014) to estimate IE in Algeria in this section we'regonna review some of them.

(Adair & Bellache, 2008)and (Smaili, 2019)used a direct approach at the state level to estimate the Algerian informal economy. The downside of these two studies is being conducted on two of 48 states meaning we can't generalize the results and policy to reduce this phenomenon in other states. Furthermore, the reliability of the answers is in question because we are asking a cheater how much he cheated and waiting for an accurate answer.

(Boudlal, 2012)estimated the size of the Algerian informal economy using the CDA approach from 1970 to 2010. The author used currency to M2 as the dependent variable, an average of GDP, wages to GDP, taxes to GDP ,and interest rate as independent variables. the results based on OLS regression revealed that the average of the informal economy was 24.5% of

official GDP; all the variables had a positive impact on the dependent variable except average GDP. However, some remarks can be made in this study; the author did not report the tests of stationarity or co-integration; also he did not specify if he includes or excludes oil-tax revenues from his tax variables knowing that Algeria is an oil-rich country.If the author did add oiltaxes, the results will be miss leading. The author assumed in his estimation that the velocity in both formal and informal economies is the same and according to (Ahumada, Alvaredo, & Canavese, 2009)this assumption is not true and the estimated results should be corrected.

(Alm & Embaye, 2013) aimed to estimate the size of the IE in 111 countries using the currency demand approach from 1984 to 2006. This study was based on a dynamic panel approach using the GMM method to estimate the parameters. The researchers used the tax rate, real percapita income, and the interest rate on time deposits, inflation rate, the degree of urbanization, and the enforcement strength of the tax administration as independent variables. The results suggested that Algeria had an average of 48.09% of GDP as the informal economy which is the highest estimate in the existing literature. However, the authors did not correct their estimation arguing that "when the dependent variable is the currency to the M2 ratio, the expected coefficient on the income variable is negative, and it does not have the usual interpretations of elasticity."

(Bounoua, sebbah, & Benikhlef, 2014)analyzed the determinants and evolution of the IE in Algeria from 1990 to 2009. The econometric analysis was supported by multiple indicators multiple causes model; results from the study showed that public expenditure, inflation rate, unemployment rate, and guaranteed the national minimum wage are the main causes of the shadow economy; all the later variables are negatively linked with the IE except the public expenditure. The estimated size of the IE differs from 41.68% in 1991 to 46.43% in 2009.

Due to the methodology adopted in this study, some remarks can be observed: first, they constrained the GDP per capita to -1 which means a negative relation between official and informal economy without justifying why; second, the direct, indirect taxes and social security were combined together in one variable which can cause a problem in the estimation,

because the effect of these three variables on the IE is still ambiguous.(Frey & Weck-Hanneman, 1984) found that direct taxes and indirect taxes have a positive impact on shadow economy in the main time security contribution has a negative impact, while (Corina & Andrei, 2011)found a negative impact of direct taxes on the informal economy and a positive impact of indirect taxes on shadow economy; Finally, the author's choice of using GLS estimator with a sample of 20 observation; according to (Dell'anno, 2003) this method can be used if the sample observation is greater than 500 or the results will be unstable.

(Quintano & Mazzocchi, 2014)used the structural equation model to estimate the IE in a subsample of Mediterranean countries (23 countries) over the period from 1995 to 2010 using the partial least squares estimator. Results revealed that the Algerian informal economy was unstable over the study period. The peak percentage was 46.4% of GDP in 2008 and the lowest percentage in 2002 32.4% of GDP. However, one can question the decision of the authors to test the unified model on a heterogeneous sample containing developed countries like France, Spain…and developing countries like Algeria, Morocco… because these countries don't have common cultural roots as a result of historical background and geographical distance or the same economic characteristics. Which may be reflected on the impact of causal variable, and the size of the IE in every country.

(Kori, 2018)also used the approach of the latent variable using a MIMIC model to estimate the Algerian IE during the period from 1970 to 2016. However, there are some observations concerning the construction of the study models such as the author's choice to use only two determinant variables: budget deficit and urbanization; the second observation is constraining GDP to one which suggests a positive relationship between the official economy and the unofficial economy without presenting any arguments. Furthermore, non-stationarity tests were not performed which can cause a spurious regression; also the data were not tested for multinormality distribution which leads to question the reliability of the provided estimations.

(Medina & Schneider, 2018)estimated the informal economy for 158 countries during the period 1991 to 2015 using multiple indicators multiple causes (MIMIC). The Algerian IE was found to vary between 23.98% and 38.88% as the lowest percentage with an average of 30.86% and a stander deviation of 5.47%. as stated before, studies based on panel data can be misleading when it comes to the impact of every cause in the informal economy for each country.

The table below summarizes the studies which estimated the size of IE in Algeria.

Table 1. Review of Algerians informal economy estimates

Authors	Study period	Methodology	Estimation(Average)
Country based estimates			
(Boudlal, 2012)	1970-2010	CDA	24.5% of GDP
(Bounoua, sebbah, & Benikhlef, 2014)	1990-2009	MIMIC	44.72% of GDP
(Kori, 2018)	1970-2016	MIMIC	31.9% of GDP
Panel based estimates			
(Elgin & Oztunah, 2012)	1960-2008	DGE	33.09% of GDP
(Alm & Embaye, 2013)	1994-2006	CDA	48.09% of GDP
(Quintano & Mazzocchi, 2014)	1995-2010	SEM	39.4% of GDP
(Medina & Schneider, 2018)	1991-2015	MIMIC	30.86% of GDP
State level estimates			
(CNES, 2004)	2001-2010	Household survey	40.13% of GDP
(Adair & Bellache, 2008)	2007	Household survey	19.9% of GDP
(Smaili, 2019)	2017	Household survey	46.16% of GDP

source: Authors own construction

3. METHODOLOGY

The paper adopts the Currency Demand Approach (CDA) to estimate the Algerian IE over the period 1980–2019. This period was chosen for the accessibility of the data. The sources of the data are Official National Statistics and the World Bank database. Following the literature, the specified model is expressed as follows:

$$\ln C/M1_t = \alpha_0 + \alpha_1 \ln(1 + Tax)_t + \alpha_2 ln\, nGDP_t + \alpha_3 \pi_t + \alpha_4 R_t + \varepsilon_t \quad (02)$$

Where:$\ln \mathrm{C/M1_t}$ is the natural logarithm of currency normalized by money supply; $\ln(1 + \mathrm{Tax})_t$is the natural logarithm of (1 + total tax outside oil tax revenues normalized by GDP. This variable is considered the most

important determinant of IE in the currency demand approach. Literature confirmed that a higher rate of tax burdens leads individuals to avoid paying taxes through the informal economic activities. Therefore, a higher tax rate is expected to increase informal economy ($\alpha_1 > 0$);

$\ln nGDP_t$Is the natural logarithm of the real non-oil GDP this variable was chosen instead of GDP to catch the development of the official economy by taking out the repeated oil shocks which may lead to misleading results. A positive relationship is expected between non-oil GDP and C/M1($\alpha_2 > 0$);

π_tIs the inflation rate. This variable has a negative influence on the currency ratio if individuals substitute currency for interest-bearing assets to prevent the inflationary erosion of their purchasing power ($\alpha_3 < 0$);

R_tIs the nominal deposit interest rate. An increase of this interest rate decreases currency ratio due to increased opportunity cost of holding money rather than deposits ($\alpha_4 < 0$);

ε_tIs the error term.

This paper applies the autoregressive distributed lag methodology (ARDL) to catch in detail the dynamic relationship between the demand for currency and its causes ((Dell'anno & Halicioglu, 2010); (Tan, Habibullah, & Yiew, 2016); (Gamal, Rambeli, Jalil, & Viswanathan, 2019)). However, before applying the ARDL methodology the data was tested for stationarity using the Augmented Dickey-Fuller test, Philips-Perron test, and the breakpoint unit root test. These tests of stationarity are applied to ensure that the data do not have second-order integrated variables I (2).

The ARDL method was proposed by (Pesaran, Shin , & Smith , Testing for the'Existence of a Long-run Relationship. , 1996)and subsequently, it was modified by (Pesaran , Shin, & Smith, 2001, p. 293) by introducing the bounds testing approaches. The general form of the ARDL equation to test for co-integration in this paper can be written as follows:

$$D\ln\left(\frac{C}{M1}\right)_t = \alpha_0 + \sum_{i=1}^{p1}\alpha_{1i}D\ln\left(\frac{\mathrm{c}}{\mathrm{M1}}\right)_{t-i} + \sum_{i=0}^{p2}\alpha_{2i}D\ln(1+tax)_{t-i} + \sum_{i=0}^{p3}\alpha_{3i}Dln\ nGDP_{t-i} + \sum_{i=0}^{p4}\alpha_{4i}D\pi_{t-i} + \sum_{i=0}^{p5}\alpha_{5i}DR_{t-i} + \beta_1\ln\left(\frac{\mathrm{c}}{\mathrm{M1}}\right)_{t-1} + \beta_2\ln(1+tax)_{t-1} + \beta_3\ln nGDP_{t-1} + \beta_4\pi_{t-1} + \beta_{5i}DR_{t-1} + \varepsilon_t \quad (03)$$

Where: D is the delay operator; α_0 is the constant; α_j mean short-term dynamics; $\beta_r$are the long-term coefficients; ε_tSerially uncorrelated random errors with mean zero. The lag length for each variable of the ARDL (P_1, P_2, P_3, P_4, P_5) is chosen by the Schwartz Information Criterion (SIC), assuming a maximum lag length of 4 lags.

After using the bounds test on equation (2) which is based on the partial F-test under the null of no co-integration against the alternative hypothesis the existence of co-integration. The results revealed that the variables are co-integrated. therefore, the conditional ECM using the ARDL method can be written as follows:

$$D\ln(C/M1)_t = \alpha_0 + \sum_{i=1}^{p1}\alpha_{1i}D\ln\left(\frac{\mathrm{c}}{\mathrm{M1}}\right)_{t-i} + \sum_{i=0}^{p2}\alpha_{2i}D\ln(1+tax)_{t-i} + \sum_{i=0}^{p3}\alpha_{3i}Dl\ nGDP_{t-i} + \sum_{i=0}^{p4}\alpha_{4i}D\pi_{t-i} + \sum_{i=0}^{p5}\alpha_{5i}DR_{t-i} + \theta_1 ECM_{t-1} + \varepsilon_t \quad (04)$$

Where:$ECT_{t-1}$is the error correction term which measures deviations from the long-run equilibrium and θ_1 Captures the speed of correction to long-run equilibrium.

Following the stated steps in the previews section of the paper and using the long-run coefficient of the ARDL model. The size of the Algerian informal economy has been estimated over the period 1980 to 2019. Then the results were corrected using the suggested formula of Ahummada et al (2009) as follows:

$$\frac{Informal\ economy_t}{GDP_t} = \left(\frac{illegal\ currency_t}{legal\ currency_t}\right)^{1/\beta} = \left(\frac{Informal\ economy_t}{GDP_t}\right)^{1/\beta} \quad (05)$$

4 EMPIRICAL RESULTS

4.1 Unit root test

In the first stage, we test our data for the presence of a unit root. The following tables 2 and 3 shows the reported t-statistic of the ADF test and breakpoint unit root test. Respectively, while the null hypothesis is the presence of the unit root. The result of the ADF test shows that all the series are not stationary in the level. However, the breakpoint unit root test which is superior to the ADF because it takes into account the breaks in the time series suggested that some series are stationary in the level.

Table 2.ADF Unit root test

At level						
t-statistic	$\ln(\frac{C}{M1})$	$\ln(\frac{tax}{GDP})$	$\ln(nGDP)$	π	R_t	Polty4
C	1.9643	1.3239	0.0238	2.8714**	1.0020	1.0981
T&C	2.7926	1.0840	1.0851	3.4124**	1.6854	2.5179
None	0.5390	0.1544	2.9534	1.4802	0.6772	1.9335
At first difference						
t-statistic	$\ln(\frac{C}{M1})$	$\ln(\frac{tax}{GDP})$	$\ln(nGDP)$	π	R_t	Polty4
C	4.9804*	5.0391*	5.8875*	6.8212*	4.7024*	5.8307*
T&C	4.9318*	4.6157*	5.8679*	6.7100*	4.8728*	5.8307*
None	5.0421*	5.1072*	4.9310*	6.9027*	4.7629*	5.4108*

source: Authors own construction based on Eviews10 outputs.

Notes: ***, **, *means statistically significant at 1%, 5% and 10%. T&C represents the model with a constant and trend; C represents the model with constant only and non represents the model without a drift and trend. The number of lags was determined using SCH criterion for maximum 11 lags to remove serial correlation in the residuals. The Philips-perron test was conducted using Newey-west Bandwidth but not provided here.

Table 3.Break point unit root test

At level						
t-statistic	$\ln(\frac{C}{M1})$	$\ln(\frac{tax}{GDP})$	$\ln(nGDP)$	π	R_t	Polty4
C	5.55853*	3.1294	3.0955	4.704***	3.7178	5.0576**
T&C	4.3730*	4.5953	7.4630	5.2726	4.0866	5.981*
None	3.0652	4.5209	3.9029	4.305***	4.7314**	5.2944*
At first difference						
t-statistic	$\ln(\frac{C}{M1})$	$\ln(\frac{tax}{GDP})$	$\ln(nGDP)$	π	R_t	Polty4
C		5.6594*	7.5881*	7.5192*	7.8005*	
T&C		6.6498*	7.4630*	7.9590*	7.6492*	

None		5.7204*	7.4002*	7.2121*	5.5516*	
Break year	2003	1987	1986	1989	1989	2013

source: Athors own construction based on Eviews10 outputs.

Notes: ***, **, *means statistically significant at 1%, 5% and 10%.T&C represents the model with a constant and trend; C represents the model with constant only and non represents the model without a drift and trend. The breakpoint selection is based on Dickey-Fuller min-t Lag length based on Schwarz criterion with max lags of 9.

In the second stage, the paper used the ARDL bounds test to examine the existence of the co-integration between the dependent variable and its explanatory variables. based on AIC criteria, the optimal max lag order was fixed at k = 4. Table 4 presents the test results.

Table 4. Bounds co-integration test

Calculated F-statistic			
11.0253*		K=4; N=39	
		Critical value bounds	
significance		I(0) bound	I(1) bound
10%	2.427		3.395
5%	2.893		4
1%	3.967		5.455

source: Authors construction based on Eviews10 outputs.

Based on the empirical findings shown in the table above the calculated F-statistic of ARDL bound testing is 11.0253 and it is greater than the critical value of 4, which indicates the existence of long-term co-integration relations between the variables.

4.2 Long run and short run and diagnostic results

Table 5 panel A provides the estimation result of long-run estimation, which is used to estimate the IE in Algeria during the study period. From the results provided taxes normalized by GDP and non-oil GDP positively impacts the dependent variable as follows, a one-percent rise in taxes will lead to a rise of 35% in the currency demand; a one-percent rise in non-oil GDP sector will augment the demand for currency by 34% and these two impacts are statistically significant at 5% level. Inflation has a non-significant impact close to zero on the dependent variable, and the last variable interest rate has a positive and significant impact on the dependent variable one-percent rise in its later will lead to a 6% rise in the demand forthe currency which is incompatible with the economic theory. However,

this impact is very small.

Panel B represents the short-run estimations. As it has seen the ECM is negative and statistically significant at a 5% level with a value of -0.6113This represents the adjustment needed to realize the actual equilibrium. The study model also shows a good fit, with The R-squared of 0.7605(Adj-R2: 0.7381) implying that 74% variations in the dependent variable are explained by the model and the rest by other variables not included in the model.

The model also passes the test regarding serial correlation (Breusch-Godfrey Serial Correlation LM tests), normality (Jarque-Bera test), and heteroscedasticity (Breusch-Pagan-Godfrey test). And from figures 1 and 2 the model is shown to be stable over the study period.

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Table 5. Long and short run estimates

Panel A: ARDL (1,0,0,0,2) long run coefficients						
C	$\ln(\frac{tax}{GDP})$	$\ln(nGDP)$	π	R_t		
-7.0382	0.3455	0.3354	0.0095	0.0647		
(2.6349)*	(2.6803)*	(3.4352)*	(1.2090)	(9.3866)*		
Panel B: short run coefficients						
Lag order	DR_t	Polity4	ECM(-1)			
0	0.015	0.002	-0.6113			
	(1.8111)***	(1.4349)	(-8.8545)*			
1	-0.019					
	(-2.1512)**					
Panel C: Diagnostic statistics tests						
R^2	Adj-R^2	DW Sta	F-Sta	χ^2_{LM}	χ^2_{JB}	χ^2_{ARCH}
0.7606	0.7382	2.0195	40.17[0.00]	0.48[0.79]	1.99[0.98]	1.06[0.6]

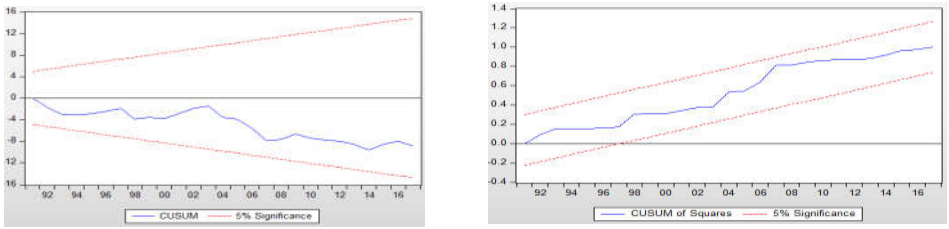
Source: Authors construction based on Eviews10 outputs

Notes: ***, **, *means statistically significant at 1%, 5% and 10
values between (.) are calculated t-statistics

values between [.] are calculated p-values

Figure 1.CUSUM and CUSUM of squares test

CUSUM test CUSUM of Squares



Source: Eviews10 outputs

4.3 Algerian informal economy estimates

Using the long-run coefficients, the Algerian informal economy was estimated by the following equation:

$$\ln(\widehat{\frac{C}{M1}})_t = -7.0382 + 0.3455\times ln\left(1+\frac{tax}{GDP_t}\right) + 0.3354 \times \ln(nGDP)_t + 0.0095\,\pi_t + 0.0647\,R_t + \varepsilon_t \quad (06)$$

The equation (06) is estimated twice to calculate $\ln(\widehat{\frac{C}{M1}})_t$ and $\ln(\widehat{\frac{C}{M1}})_{wt}$ where: $\ln(\widehat{\frac{C}{M1}})_t$ is estimated with tax variable; $\ln(\widehat{\frac{C}{M1}})_{wt}$ is estimated with tax variable steed to its minimum value keeping other coefficients unchanged.

To estimate the illegal demand of currency the following equation is applied:

$$C_{it} = e^{[(\ln(\widehat{\frac{C}{M1}})_t - \ln(\widehat{\frac{C}{M1}})_{wt})\times M1]} \quad (07)$$

Where: C_{it} is the demand for illegal money

Hence, now the legal demand for money in the official economy can be estimated as follows:

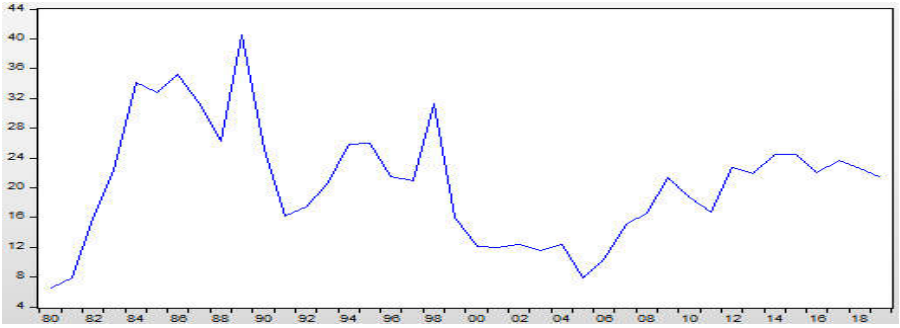
$$C_{lt} = C_t - C_{it} \quad (08)$$

Assuming equal income velocity of money in both official and informal economies(Tanzi, 1983), the size of IE is estimated as follows:

$$IE_t = (C_{it} \times v_t)/GDP_t \quad (09)$$

The results of the above equation then were corrected using the proposed method by Ahummad (2009) with β = 0.3354 for 1980 to 2019. The corrected estimates of IE in Algeria is depicted in figure2 below.

Figure 2. Algerian informal economy as percentage of official GDP



Source: Authors construction based on the estimation.

The results revealed that the size and evolution of IE in Algeria during the study period vary around an average of 21% of GDP. The IE in Algeria reached its highest percentage from 1984 to1989 with an average of 33.33% of GDP. Then it started to decrease over the next 3 years. However, from 1992 to 1998 it started to grow again. The lowest average of IE was around 12% and that's between 1999 and 2005. After that, the IE started to rise again and continued on that magnitude until 2019.

5. DISCUSSION

The currency demand approach revealed that IE in Algeria has an important size. And the latter is unstable over the study period. The study model revealed a positive impact of taxes on IE size in Algeria. This result is in line with the literature on the relation between these two variables. Therefore, the first hypotheses are conformed, meaning a higher tax burden leads individuals to avoid paying taxes through IE activities. This result supports the findings of (Boudlal, 2012). However, it is inconsistent with (Bounoua, sebbah, & Benikhlef, 2014)findings, which have found that the tax burden does not affect the size of IE in Algeria.

Over the study period, the Algerian government made many changes and adjustments in the tax system and these changes are observed to impact the size of IE such as the 1987 tax reform and the creation of the National Committee for Tax Reform. This effort had a significant impact on reducing the IE size over the next five years. Except in 1989 the IE size know a pick in its size, which almost doubled in size reaching 40% of GDP,

this can be explained by Algerians government decision to shift towards a market-based economy and reforming the structure of its economy. However, the 1992 tax reform stimulated the size of IE, which started to rise again. In addition to the social instability experienced during this period. The structural reforms that were adopted in the 90s such as the structural adjusted program in 1994 and the review of the tax system led to the decrease of IE in Algeria from 1995 to 2005 except the year 1998, which now a rise in IE size. After that, the IE in Algeria knows a continuous upward trend in its size. Furthermore, the tax reforms over this period are ineffective and did not reduce the size of this phenomenon.

The second hypothesis of the model is also verified, meaning that the development of the official economy positively impacts the size of the IE. As suggested by (Tanzi, 1980). However, due to the Characteristics of the Algerian economy, the non-oil GDP was selected to reflect the development and evolution of the official economy. This result supports the findings (Bennihi & Bouriche, The impact of shadow economy on non-oil GDP growth: in Algeria from 1991 to 2017., 2019)on the impact of non-oil GDP on IE size in Algeria.

Somewhat surprisingly, inflation had no impact on the size of the IE in Algeria, which is contradictory with the model hypotheses and the preview studies such as (Dell'anno & Halicioglu, 2010; Gamal, Rambeli, Jalil, & Viswanathan, 2019); However, in literature the impact of inflation on IE size is ambiguous it can also have a positive impact on IE because inflation wears down the real value of nominal disposable income, which gives individuals the incentive to evade more taxes to restore their purchasing power and this was supported by studies of(Schneider & Buehn, 2018). But the study is not in line with these studies because the impact of inflation on IE was found positive but insignificant making it very difficult to infer conclusions. Furthermore, the lack of studies on the relation between IE and inflation in the Algerian case limits the interpretation and calls for further investigation.

The model also produced a contradictory result concerning the impact of the nominal interest rate on IE. in which the results suggested a positive impact of interest rate on the Algerian informal. However, this result was

also found by (Boudlal, 2012). This can be due to the culture of the Algerian individuals who prefer to invest their money to finance businesses or start their own informally rather than investing their money through banks due to the lack of confidence in the banks and their systems.

Although the currency demand approach is one of the popular approaches to estimate the size of IE and it did estimate the size of Algerian IE. However, it has its negatives especially relaying on one variable to explain the development and trend of IE and not considering other determinants. Further investigation is required to gain a more complete understanding of a complex phenomenon such as IE in Algeria and its interaction with other economic and social phenomenons.

5.CONCLUSION

This paper used a currency demand approach to estimate Algerian IE during the period 1980 to 2019. The empirical investigation lent some support to the first two hypotheses (taxes and GDP increase the demand for currency). However, it did not support the last two hypotheses of the model (inflation and nominal deposit interest rates decrease the demand for currency). It also suggested that the IE in Algeria varied around an average of 21% of GDP. With two major picks in 1989 and 1998. Furthermore, the estimation also revealed that IE is knowing an upward trend in the last twenty years.

In terms of policy implications, policymakers should focus on different measures such as re-evaluate the tax policy in Algeria. as it was shown, the tax policy applied in the last twenty years had a minor effect on the size of IE; Policymakers should also fight to reduce the high level of corruption, which is an important variable in creating no equality of paying taxes. This leads to higher tax evasion; Investing in the non-oil sector by helping nurture small businesses to grow big in the economy.

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