Economics Bulletin

Volume 40, Issue 2

Informal economy, government intervention and labor market in Algeria: An analysis by structural models

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Abstract

Literature on the informal economy can mainly be divided into two different contrasting theories. On one hand, the dualists argue that the informal sector is considered to be the lower segment of a dual labor market, with no direct link to the formal economy, which provides income for the poor and a safety net in times of crisis. On the other hand, the legalists argue that hostile government intervention leads to excessive and costly regulation, such as taxes or direct contributions. This drives rent-seeking firms towards the informal economy. In this paper, we do consider that these two theories are complementary rather than substitutable. This is why we use structural models (PLS-PM) to deal simultaneously with the role of government intervention and labor market to estimate the informal economy in Algeria for the period 2000-2018. Our results show an upward trend in the informal economy between 2000 and 2009 from 34.1% to 45.86% of GDP, and a global decline until 2018 to 32.83%. Moreover, our findings show the direct responsibility of government intervention in the expansion of the informal economy besides the labor market conditions. It turns out that efforts to absorb the informal economy in Algeria should simultaneously involve variables linked to the labor market and to the government intervention. Finally, we provide an index of the size of the informal economy and compare it to other studies.

We are very grateful to the referee for her/his constructive remarks which substantially improved this article. The usual disclaimer applies.
Citation: Kahina Cherfi-Feroukhi and Saïd Souam, (2020) "Informal economy, government intervention and labor market in Algeria: An analysis by structural models", *Economics Bulletin*, Volume 40, Issue 2, pages 1178-1193
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Submitted: December 15, 2019. **Published:** May 06, 2020.

1. Introduction

The informal economy is highly segmented by sector, place of work, status of employment, and within these segments, by social group and gender. But those who work informally have one thing in common: they lack legal and social protection (Chen, 2012). Literature on the informal economy can mainly be divided into two different contrasting theories. On one hand, 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; Sethuraman 1976). "*Contrary to expectations, informal activities, enterprises, and jobs have not only persisted, but have also emerged in new guises and unexpected places"* (ILO, 2013, p. 1). On the other hand, 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).

However, we need to rethink the concept of informality, detailing the expanded statistical concept under a common statistical framework in order to make official statistics on economic growth more reliable. Indeed, the presence of the informal economy makes official statistics on economic growth less reliable. This may lead governments, misguided by inappropriate information, to take wrong economic policy decisions (Tanzi, 1999). That means that the informal economy is partly responsible for weakening and even destroying the feedback from the economy to planners. As a consequence, economic planners will manage the formal economy with a highly distorted map not representing the real economic situation. Schneider and Enste (2000) focus on legal activities that create added and unreported values, while recognizing the difficulty of agreeing finally on the definition of the underground economy, which, according to them, adapts to changes such as running water. Moreover, "[…] *the shadow economy reflects mostly the legal economic and productive activities that, if recorded, should contribute to the national GDP*" (Hassan and Schneider, 2016, p. 2). These two definitions are convergent since they exclude illegal activities and aim to evaluate the wealth created by legal activities that escape from taxation. In this paper, we do use the term informal economy, insofar as it is relatively neutral and general enough to encompass various phenomena.

The question is then, how can one measure or estimate a phenomenon, which in essence wants to remain hidden, and which variables determine its level? There is no simple universal answer to this question. Indeed, the answer will not be the same for different countries, depending on their preexisting economic history and institutions. Many studies and techniques have been developed to measure informality across multiple countries in panel data but without taking into account the particularities of each country. We do think that some particularities of the countries deserve to be thoroughly studied.

Indeed, as emphasized by Buehn and Schneider (2016, p. 1) "*Schneider and Buehn (2012) study the driving forces of the shadow economies in 38 OECD countries between 1999 and 2010. Their analysis of the relative impact of those determinants on the development of the shadow economy demonstrates that determinants are not equally important across countries".* That is why explaining the country level variation, rather than variation in panel data, is much better to understand the phenomenon of informality, especially for the Algerian

economy which highly depends on the hydrocarbons (95% of foreign exchange earnings and 60% of the budget revenues). It is thus important to understand how this Rentier State prevents economic growth by tolerating the presence of the informal economy. Therefore it is more accurate to have estimations based on the country level rather than on panel studies since the driving forces of the informal economies can be very different across countries. This is particularly significant in Algeria since oil rents have been used to re-equilibrate the financial imbalances caused in particular by the informal economy (unpaid taxes). The State has also used these rents to intervene in the labor market to create jobs by providing financial assistance to businesses. However, providing only financial assistance while neglecting to improve the business climate (good governance), may not prove to be effective in absorbing the informal economy.

Our modeling approach is in line with the proposal of Dell'Anno (2007), but differs in the segmentation within causal variables. Our macroeconomic estimate of the informal economy takes into account variables simultaneously related to inefficiency of the government intervention and inefficiency of the labor market, by using a structural equation approach, the so-called MIMIC (Multiple Indicators and Multiple Causes). Whereas this possibility of segmentation within the causal variables between two groups of variables (governmental intervention and labor market) is only permitted through the structural sub-models of the PLS-PM model (Partial Least Squares Path Modeling). Khandan and Nili (2014) and Khandan (2017) show that the informal economy is the result of government's invisible hand in another Rentier State, Iran. In this paper, we have the opportunity to directly know which group of variables impacts more the informal economy in Algeria, governmental intervention (government's indivisible hand) or labor market, or both of them.

The remainder of the paper is organized as follows. In Section 2, we propose a PLS-PM model to measure the informality in Algeria and specify the variables to be included in the analysis. In Section 3, after specifying the structural relationships between the causes and indicators of the informal economy, we identify this model and test the structural parameters. We thus provide estimates of the size of the informal economy in Algeria and discuss its evolution during the period 2000-2018. A last section concludes.

2. Modeling the informal economy in Algeria: a PLS-PM model

The purpose of our paper is to produce an estimate of the informal economy in Algeria using a structural equation approach, the so-called MIMIC (Multiple Indicators and Multiple Causes). Structural Equation Models (SEM) were first introduced by Jöreskog (1970) as confirmatory models to assess cause-effect relations among two or more variables, based on the maximum likelihood (ML) estimation method (SEM-ML), also known as LISREL (LInear Structural RELations) covariance based. Wold (1975) introduced the PLS-PM (Partial Least Squares Path Modeling) variance-based approach. The main difference between these two methodologies lies in the fact that "*LISREL covariance-based estimators minimize the discrepancy between the empirical and model-implied variance–covariance matrix of the observable indicators to obtain the model parameter estimates, and PLS-PM variance-based estimators create linear combinations of the indicators as stand-ins for the theoretical concepts and subsequently estimate the model parameters*" (Benitez et al. 2020). Of this fact,

PLS-PM was not suitable for confirmatory testing (selecting one model over its alternatives). This leads to a weakness in the classical parametric inferential framework. To overcome this disadvantage, PLS-PM modeling instead uses empirical confidence intervals and hypothesis testing procedures based on resampling methods (Chin, 1998; Tenenhaus et al., 2005). PLS estimates latent variable scores as exact linear combinations of their associated manifest variables and treats them as perfect substitutes for the manifest variables. More precisely, it provides three different indices: the community index, the redundancy index and the quality of fit index (GoF), as an indicator of how well PLS has met its objective (Barclay et al., 1995). In contrast, LISREL is considered as hard modeling. It requires a set of assumptions to be fulfilled, such as the normal distribution of observed indicators and a sufficient sample size. LISREL provides a statement of causality by seeking to find structurally or functionally invariant parameters. This modeling offers a number of measures of overall model fit, such as χ^2 goodness of fit, stationarity, and co-integration (Fornell and Bookstein, 1982). PLS-PM should thus rather be used for prediction and for exploration of the "plausible causality" (Esposito Vinzi, 2007). Considered as a soft modeling, it is a distribution-free approach that was developed as a flexible technique for data characterized by missing values, strongly correlated variables and small sample sizes (Jakobowicz, 2007). This is exactly the case in our research. Barclay et al. (1995) suggest using a minimum sample size of ten times the maximum number of paths aiming at any construct in the outer model (i.e., the number of formative indicators per construct) and inner model (i.e., the number of path relationships directed at a particular construct).

In this article, we adopt an approach based on a PLS-PM to model informal economy, as a latent variable that is not directly observed, but is rather inferred from other variables.

In Algeria, the informal economy is a relatively sparsely studied phenomenon especially in its macroeconomic estimation's aspect. The main reason deals with the fact that Algeria does not yet have a national survey to measure its size. Several researchers have attempted to remedy this deficiency by undertaking field studies. However, their high costs generally restrict them to study very narrowly defined regions. As such and despite their relevance, these studies are not useful to quantify informality across the national territory. Moreover, other types of research based on quantitative methods have provided a macroeconomic estimate of the size of the informal economy: logistic model (Adair and Bellache, 2012), segmentation model (Bensidoun and Souag, 2013), National Accounts (Zidouni, 2003) and MIMIC models (Schneider 2007; Bounoua et al. 2014 and Medina and Schneider 2018).

Nevertheless, our modeling differs from these studies in the use of a particular modeling (PLS-PM), which differs, as we have underlined it above, from the general MIMIC model, by its structural sub-model which considers other latent variables as explanatory variables of the main latent variable. This is a main feature of the informal economy that is not directly observable in economic aggregates. The question is then which variables are plausible to better characterize informality in Algeria?

The choice of variables

From a microeconomic point of view, we can consider the individuals as rational and behaving à la Becker. They outweigh costs and benefits from being informal. The informal economy thus negatively depends on the probability of detection and on potential fines, and positively on the opportunity costs of remaining formal (see for example Medina and Schneider, 2018). These opportunity costs are positively determined by the burden of taxation and high labor costs.

From a macroeconomic point of view, Frey and Schneider (2000) pointed out the effects of the rising informal economy over the official economy: too expansionary macroeconomic policies due to an overestimation of unemployed persons; a loss of tax revenues as underground activities escape from taxation; and finally, the inability for the governments to finance the necessary public goods. Frey and Schneider (2000) provide further effects. *Firstly,* the underestimation of GDP, which does not fully account for all goods and services in the informal economy, will lead to a distortion (increasing) in determining the demand for money needed by the economy. In return for this expansion, a prudential credit policy will be pursued, which will cause high inflation, while such measures are not necessary. *Secondly*, an incorrect estimate of the number of jobs in the informal sector can lead to a significant bias in the calculation of the unemployment figure. This will reduce government spending in order to create jobs, since informal employment thus aggregated in the official employment figures will help to reduce the unemployment rate. *Thirdly*, the loss in terms of taxes collected by the government will lead to a mismatch between budgetary revenues and expenditures. Finally, the economic and social conditions needed to trigger growth dynamics, will be determined in a biased way.
Taking this framework as a starting point, the candidate variables chosen in our model are: GDP growth, money supply outside the banking system, inflation rate, and unemployment rate, the participation rate in the labor market, self-employment rate and tax burden. In addition, what Frey and Schneider (2000) describe as a mismatch between budgetary revenues and expenditures, will be reflected in our model as budget deficit variable, which is equal to the difference between budgetary expenditures and budgetary revenues. It provides information on the level of rigor adopted in the maintenance of the State budget. Loosening in budgetary discipline is seen as an appeal to the rise of the informal economy. As mentioned before, our model also takes into account the rentier character of the Algerian economy, which has mainly stimulated massive importations of capital goods and consumption thanks to hydrocarbons. This channel opened to massive importations, has also served the expansionary trend of the informal economy. This variable will be declined in our model as trade openness.

What does mean the rentier character for the Algerian economy?

The analysis of the concept of Rentier State is based on the strict definition of annuities as external income. However, specificity characterizes the economic logic of the developing rentier countries. This specificity is manifested by the disruption of the economic circuit, which will replace the domestic market by the international market. In fact, in a non-rentier economy, economic agents come into contact with markets. These allow the meeting of

supply and demand, which will create a trade-in various products (goods, services but also work, securities or, currency) represented by real or monetary flows. Each of these flows has a counterpart, when a household buys a good the company will provide it (real flow) in exchange for a payment (cash flow). Conversely, in a rentier economy, the state will be responsible for providing importers of the energy-rent currency (and not the economic circuit) for supplying its population with the needed goods and services. This, in turn, will further weaken the local job-creating and value-added sector. The procedure is as follows: the State authorizes the disbursement of its foreign exchange reserves to the profit of importers who will have all the latitude to import (in accordance with the regulations of the Ministry of trade) all what the local population wants. By this process, we are now able to describe an economic circuit corresponding to this state of affairs: Natural resources are extracted and exported (for the most part) in their raw state, which gives rise to revenues. The abundance of these revenues makes obsolete the local production, since the valves of the importation are widely open. These are exclusively financed by exports of raw materials (hydrocarbons). As a result, hydrocarbons are the main source of foreign exchange reserves and become an import catalytic effect (see Table I below).

Table I: Importations in billion $US

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Importations in billion $US	9.94	12.00	13.53	18.30	20.35	21.45	27.63	39.47	39.29
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Importations in billion $US	40.47	47.24	50.37	55.02	58.33	51.51	47.08	46.05	46.19

Source: National Center for Computing and Statistics 2019

Table I above provides information on the expansionary trend of imports, which increased six-fold during the period 2001-2014, from US $ 9.94 billion in 2001 to US $ 58.33 billion in 2014, and becomes relatively stable between 2015 and 2018. Otherwise, in 2015, the non-hydrocarbon manufacturing industry represented only 5% of GDP (Benbahmed and Lohoues, 2017). This decline in industrial activity, which has lasted for more than a decade, is in no way compensated by the private sector, the latter being composed of 97.7% of Very Small Enterprises, mainly of a family nature (Ministry of Industry and Mining, 2018). In this scenario, the Algerian economy is not big enough to resist international competition. A study by Bacchetta et al. (2012) insisted on the fact that the existence of a large informal economy in relation to the formal one is an additional cause of confinement in an exclusive export and mass import regime.

In order to best reflect the informal economy in Algeria, the first step in implementing a MIMIC modeling of the particular PLS-PM model involves deciding on the choice of variables and the collection of data. Particular attention was thus paid to the list of possible causes and indicators of the informal economy taking into account the rentier character of the Algerian economy. The description of the used variables, besides the theoretical and empirical justifications, is summarized in Table II below.

Table II: The main causes and indicators variables determining the informal economy

Causal and indicator variable / Name	Theoretical reasoning	References
X_{11} Tax Burden	The tax burden encourages tax avoidance, as sellers and buyers have a common interest in tax evasion. Practicing tax evasion to increase its fortune will, therefore, become profitable for the fraudster. It is therefore reasonable to assume *ceteris paribus* that greater the tax burden, the greater the willingness to avoid it. In this model, the tax burden consists of direct and indirect taxes and social security.	Frey and Hannelore (1983)
X_{12} Budget Deficit	The variable budget deficit is equal to the difference between budgetary revenue and budgetary expenditure. It provides information on the rigor adopted in the maintenance of the State budget. Our study period (2000-2018) shows a significant negative budget deficit for more than a decade. We thus expect *ceteris paribus* a positive relationship between budget deficit and the growth of the informal economy.	Spiro (1997)
X_{13} Trade openness	The existence of a large informal economy in relation to the formal one is an additional cause of confinement in an exclusive export and mass import regime. The trade openness variable is measured by adding imports and exports in goods and services and divides this sum by GDP. We thus foresee *ceteris paribus* a positive relationship between trade openness and the growth of the informal economy.	Bacchetta et al. (2012)
X_{14} Inflation rate	Inflation is a reflection of economic stability. In this regard, inflation appears to be the main cause of immersion in informal activities (Giles et al., 1999). A study of the main causes of the informal economy, conducted on 100 developing countries by Singh et al. (2012), found that the average rate of inflation is one of the relevant variables explaining this phenomenon. This study has shown *ceteris paribus* the existence of a positive relationship between inflation and the informal economy.	Giles et al. (1999) Singh et al. (2012)
X_{21} Self-employment	The Algerian economic landscape was made up of 97.7 % of very small companies in 2018. Significant diffusion of small companies and the large proportion of self-employed workers in terms of the total workforce contributed to increase the difficulties for tax services to control these economic entities (Feld and Schneider 2010, and Schneider and Williams 2013). The higher the rate of self-employment, the more activities can be performed in the informal economy, *ceteris paribus.*	Schneider and Williams (2013) Feld and Schneider (2010)
X_{22} Unemployment rate	Dell'Anno et al. (2007) argue that the workforce of the informal economy is composed of very heterogeneous workers. Schneider and Enste (2000) argue that the unemployment rate can be positively correlated with the informal economy. This correlation may be due to a second job with other work schedules. Williams and Schneider (2016) describe the existing relationship between the informal economy and unemployment rate is ambiguous. It depends on the labor force component of the informal economy. The higher the rate of unemployment, the higher the probability to work in the informal economy, *ceteris paribus.*	Dell'Anno et al. (2007) Schneider and Enste (2000) Williams and Schneider (2016)
X_{23} Participation in labor market rate	Contini (1981) estimated the size of the informal economy through changes in the participation rate of the labor market. Giles (1999) argues that full participation of the workforce is considered constant over time; a decline in the official measure of this contribution can be seen as an indicator of the increase in informal activities, *ceteris paribus*.	Contini (1981) Giles (1999)
X_{31} Currency in circulation outside the banking system	Giles and Tedds (2002) and Bajada and Schneider (2005) use the growth of money in circulation outside banks, because they consider it to be a much more reliable indicator than any	Giles and Tedds (2002) Bajada and

	exchange rate. In the present paper, we use this mentioned indicator, represented by the growth rate of M2, explaining the money in circulation between the economic agents in the real (formal) sphere. Positive impact is expected *ceteris paribus*.	Schneider (2005)
X_{32} Gross domestic product by volume	Gross Domestic Product, GDP is chosen as a unit of measurement or a scale or reference variable, Real gross domestic product is a measure based on a change in real GDP from one reference period to another at constant prices. However, several studies have shown that the size of the informal economy does not decline even during periods of economic growth (Bajada and Schneider, 2005). As a result, the a priori effect of GDP on the informal economy is ambiguous.	Bajada and Schneider (2005)

Source: Authors.

3. The size of the informal economy in Algeria

After specifying the variables of our model, we implement it using the PLS-PM module of the XLSTAT-PLSPM, developed and implemented by Esposito Vinzi et al. (2010). This module deals with the causes of the informal through its formative sub-models. The informal, in turn, acts on a set of other macroeconomic factors, which are indicators of its impact. We construct our reflective model by linking two exogenous latent variables with one endogenous latent variable (informal economy).

We mostly used annual data provided by the Algerian National Office of Statistics (NOS) for the period (2000-2018). Only two variables come from other sources. The variable "budget deficit" is taken from the data of the ministry of finance, and the variable "growth rate of currency" is provided by Bank of Algeria. In order to overcome one of Breusch's (2005) criticisms of sizing for estimating absolute estimates of the informal economy, we have taken care to make all scales of the variables comparable, varying in the interval [0,1]. As a result, units of measurement are no longer a constraint for the determination of absolute estimates of the informal economy. We have standardized these variables and summarized them in Table III below.

Table III: Description of the manifest variables

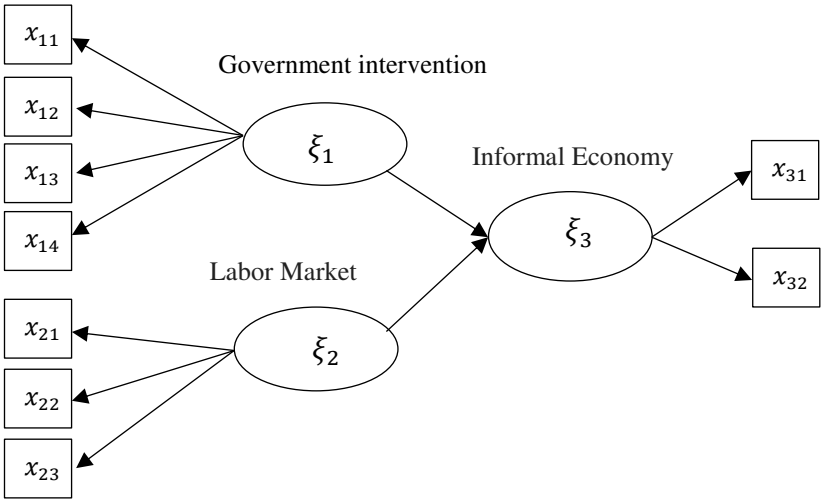
Latent variable	Manifest Variables	Description	Source
Government intervention (ξ_1)	TaxBurden (x_{11})	The tax burden is measured by the weight of direct taxes, indirect taxes and social security contributions as a percentage of GDP.	National Office of Statistics (NOS)
	BudDeficit (x_{12})	The budget deficit is equal to the difference between budgetary revenues and budgetary expenditures as a percentage of GDP.	Ministry of Finance
	TradeOpen (x_{13})	The trade openness is equal to (imports + exports in goods and services) / GDP.	NOS
	InflaR (x_{14})	Inflation rate.	NOS
Labor market (ξ_2)	SelfEmployR (x_{21})	The self-employment rate as a percentage of the employed population.	NOS

	UnemployR (x_{22})	Unemployment rate as a percentage of the active population.	NOS
	LaborMPR (x_{23})	Labor force participation rate is equal to the available labor force aged 15 and over, as a percentage of the total population.	NOS
Informal economy (ξ_3)	M2GRC (x_{31})	Growth rate of money in circulation outside banks.	Bank of Algeria
	GDPV (x_{32})	Gross domestic product in volume (basic year 1999 = 100).	NOS

Source: Authors.

PLS-PM modeling allowed us to construct a model with three latent variables. Two of them are exogenous "Government intervention" and "Labor Market". They respectively contain four and three manifest variables. They are constructed from formative variables. The third one, “InfEc”, is endogenous. It represents the informal economy and it is a reflective type variable and consists of two obvious variables, namely the Growth rate of money in circulation outside the banks (M2GRC) and the Gross domestic production in volume (GPDV). Figure 1 below provides a detailed description of our modeling.

Figure 1. Path diagram of construct PLS-PM model



The model is defined as follows:

$$x_{1j} = \pi_{1j}\xi_1 + \epsilon_{1j} \quad j = 1,\ldots, 4$$
$$x_{2j} = \pi_{2j}\xi_2 + \epsilon_{2j} \quad j = 1,\ldots, 3$$
$$x_{3j} = \pi_{3j}\xi_3 + \epsilon_{3j} \quad j = 1, 2.$$

Where:

x_{11} = (TaxBurden), x_{12} = (BudDeficit), x_{13} = (TradeOpen), x_{14} = (InflaR) *and* ξ_1= Government intervention.

x_{21} = (SelfEmployR), x_{22} = (UnemployR), x_{23} = (LaborMPR), *and* ξ_2= labor market.

x_{31} = (M2GRC), x_{32} = (GDPV) *and* ξ_3= Informal economy *(InfEc).*

The structural model is written as follows:

$$\xi_3 = \beta_{31}\xi_1 + \beta_{32}\xi_2 + \zeta_3.$$

3.1 Estimates and results

According to Table IV, of the three blocks of variables each constituting a latent variable, only the block forming the latent variable "InfEc" is of the reflective type. One-dimensionality is thus required for this block. This is the case with a Cronbach coefficient greater than 0.7. There is therefore an internal consistency in this block. In addition, the Dillon-Goldstein Rho coefficient is higher than 0.7. This proves that the block is one-dimensional. Moreover, in the three blocks the first eigenvalue is greater than 1 and the second smaller than 1 (Jakobowicz and Derquenne, 2007). The three formed blocks are therefore reliable.

Table IV: Estimation results

Latent variables	Alpha Cronbach	*Rho Dillon. Goldstein. (ACP)*	Manifest variables	*Eigen-value*	External Weight	Critical Ratio (CR)	*Communality*
Government intervention	*0,568*	*0,722*	TaxBurden	*2,272*	0,842*	3,747	0,585
			BudDeficit	*0,988*	0,961*	5,420	0,662
			TradeOpen	*0,387*	0,748*	14,29	0,913
			InflaR	*0,154*	0,219	1,029	0,389
Labor Market	*0,687*	*0,345*	SelfEmployR	*1,927*	-0,314*	-1,907	-0,973
			UnemployR	*0,990*	-0,472*	-17,15	-0,971
			LaborMPR	*0,083*	0,398*	7,223	0,407
			Indicators variables				
Informal Economy	*0,769*	*0,754*	M2GRC	*1,028*	0,321*	8,117	0,738
			GDPV	0,972	0,897*	6,615	0,695

* The variable is significant at the 5%, level is $|t|$>1.65.
Source: Estimated results provided by the XLSTAT software version 2020.1.1

The *communality* measures the quality of the measurement model for each block. It gives information on the proportion of the variance of the manifest variables explained by their associated latent variable. It is worth noting in Table IV above that among the significant causal variables only LaborMPR has less than 50% of its variance explained by its latent variable. However, the three blocks have, overall, a good quality of measurement.

Table V: The quality of adjustment (GoF)

	GoF	GoF (Bootstrap)	Error standard	Critical Ratio (CR)
Absolute	0,537	0,544	0,038	14,015

Related	0,785	0,781	0,042	18,508
External model	0,971	0,961	0,035	27,540
Internal model	0,808	0,813	0,030	26,648

Source: Estimated results provided by the XLSTAT software version 2020.1.1

Table V above shows an absolute GoF of 0.537 very close to the bootstrap estimate. This value represents a satisfactory estimate of the global model, tested with other variables. Related GoF 0.785 is very high, as well as the GoF of the external 0.971 and internal 0.808 models. Therefore, this estimation is satisfactory.

Table VI: R² (InfEc)

R²	R²(Bootstrap)	Standard Error	Critical Ratio (CR)	Lower bound (95%)	Upper bound (95%)
0,657	0,660	0,063	8,860	0,412	0,656

Source: Estimated results provided by the XLSTAT software version 2020.1.1

According to Table VI, R² is equal to 0.657 which seems acceptable. The latent variable can thus be considered as well explained. Moreover, according to the results of Table VII, the exogenous latent variable "Government intervention" contributes at 48.65% to the R² of the endogenous latent variable "InfEc" representing the informal economy. The exogenous latent variable "Labor Market" contributes for 51.34% to the R².

Table VII: Impact and contribution of variables on informal economy

	Labor Market	Government intervention
Correlation	0,571	0,558
Path coefficient	0,501	0,485
Correlation * coefficient	0,286	0,271
Contribution to R² (%)	51,343	48,657
% Cumulative	51,343	100,000

Source: Estimated results provided by the XLSTAT software version 2020.1.1

Table VII shows the equation of the structural model, based on the results of the path coefficient. Thus, the equation writes as follows:

$$Inf\ Ec = 0{,}571 * \text{Labor Market} + 0{,}558 * \text{Government intervention} \quad (6)$$

It is worth noting that the estimate of the informal economy with the PLS-PM model is only an index. This index $\widetilde{InfEc}$ is calculated using the disaggregated structural equation "(6)". Thereafter, the coefficients of the significant variables in Table IV are multiplied with the corresponding time series, with $t \in [2000, 2018]$ as follows:

$$\widetilde{InfEc_t} = 0{,}47 * (TaxBurden)_t + 0{,}536 * (BudDeficit)_t + 0{,}417 * (TradeOpen)_t - 0{,}179 * (SelfEmployR)_t - 0{,}27 * (UnemployR)_t + 0{,}227 * (LaborMPR)_t \quad (7)$$

The estimates $\widehat{InfEc_t}$ obtained in "(7)" allow us only to determine the index of the informal economy. An additional step is required to calibrate this index in order to calculate the size of the shadow economy as a percentage of GDP. We afterwards follow the procedure of Dell'Anno and Schneider (2006) to measure the percentage of official GDP over time in the informal economy. This gives the following structural equation:

$$\widehat{InfEc_t} = \frac{\widehat{InfEc_t}}{\widehat{InfEc_b}} InfEc_b^* \quad (8)$$

The application of equation "(8)" requires beforehand, fixing a base year. This step is called the benchmarking step and it requires an exogenous estimate of the size of the shadow economy at a certain point in time (Hassan and Schneider, 2016). To do so, we used the informal economy estimation series, corresponding to our base year, carried out by Schneider (2007) for 145 countries, using the MIMIC method. In our case, the estimated value corresponding to the informal economy in Algeria is $InfEc_{2000}^*$ = 34.1%, which is the exogenous estimate for the base year 2000. Table VIII summarizes our estimates of the informal economy in Algeria for the period 2000-2018.

Table VIII: Evolution of the informal economy rate in Algeria (% of the GDP)

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Informal Economy (% of GDP)	34.1	35.77	40.09	38.57	41.21	40.78	40.88	38.81	42.95
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Informal Economy (% of GDP)	45.86	42.65	36.73	37.92	37.52	31.34	42.78	38.22	34.42
Year	**2018**								
Informal Economy (% of GDP)	32.83								

Source: Authors' calculations.

Table VIII above shows an increasing trend in the informal economy between 2000 and 2009 from 34.1% to 45.86%. After this period, our results show globally a decline until 2018 to 32.83%. This is probably due to the efficiency efforts in the use of the State's resources. For the period 2014-2018, the reduction in the trend of the informal economy could be explained by the notable drop in oil prices, which generates problems of the treasury[1]. In order to overcome this lack of resources, the State is trying to optimize its resources by applying a more strict tax policy. This reduced tax evasion and consequently the informal economy.

Our estimates could be compared to other estimates provided by some studies that are summarized in Table IX below. It is thus important to have in mind the average of our estimations (38.6%) for the period 2000-2018.

[1] The latest drop started between July 2014 and February 2016, when the Brent price fell by more than 65%, going from 110 to 35 dollars per barrel. However, between 2017 and 2018 prices appreciated, but continued to be unstable; they fluctuated on average between 52.51 and 69.62 dollars per barrel.

Table IX: Summary statistics of the existing estimates of the informal economy in Algeria (1990 to 2015)

Average Algerian's SE as percent of GDP	Minimum	Maximum	Period	Number of studied countries	References
30.86	23.98	38.88	1991-2015	158	Medina and Schneider (2018)
31.01	26.76	38.83	1996-2014	143	Schneider and Buehn (2017)
32.77	24.58	46.42	1999-2013	157	Hassan and Schneider (2016)
32.50	31.0	34.2	1999-2007	162	Schneider and Williams (2013)
44.83	41.68	46.43	1990-2009	1	Bounoua et al. (2014)

Source: Authors.

All studies in Table IX above use the general MIMIC models. It turns out that the greatest average estimation of the informal economy in Algeria is 44.83% of GDP for the period 1990-2009, with a maximum of 46.43% and a minimum of 41.68%. This study is specific to Algeria. The other studies estimated the size of worldwide countries informal economy. The greatest average estimation for Algeria for the period 1999-2013 was 32.77% of GDP. However, it is quite difficult to judge the reliability of these various methods, even though general patterns are observable but there is no consensus about the most important causes leading to the proliferation of the informal economy. It is worth noting that the country-specific estimations of the informal economy in Algeria provide higher figures than the ones within worldwide countries studies. Using specific modeling could thus probably give more realistic estimations.

3.2 Interpretation of the results

As for the significant variables in our model, according to Table IV, we note that the two informal indicators, the *growth rate of the currency* (x_{31}) and the *GDP in volume* (x_{32}), are both significant and their signs are, as expected, positive. This proves that they are good indicators of the informal economy.

Among the significant causal variables, we have six. First, the *tax burden* (x_{11}) has, as expected, a positive impact on the evolution of the informal economy. It is clear that the primary desire of financial institutions is always to expand their tax base. At first sight, this would appear to be legitimate. However, these institutions should ensure that the tax collection equation is adjusted so that the tax burden does not become a handicap for the expansion of national firms that can generate value-added. During the analyzed period, these firms still cannot compete with the import sector. Indeed, this latter was in an economic boom, thanks in particular to a preferential exchange regime (partial convertibility of the Algerian dinar), coupled with the existence of large foreign exchange reserves (from the hydrocarbons sector). Our results indicate that the variable *TradeOpen* (x_{13}) has a positive impact on the evolution of the informal economy.

In addition, the variable *budgetary deficit* (x_{12}), which has taken on worrying proportions, drops from -1.48% of GDP in 2000 to -19.92% in 2012. After this peak, rates began to fall to -13.5% of GDP in 2016 and to -4.5% of GDP in 2018. But overall this discrepancy could be justified by the fact that the Algerian State has massively invested in the realization of infrastructures (motorways, housing, etc.). However, this has also paved the way for all sorts of overruns, and embezzlement of public funds. This, of course, has also contributed to a positive impact on the evolution of the informal economy.

The *inflation rate* (x_{14}) does not appear to be significant in our modeling. Indeed, we can consider that it was globally well managed during the period of study, oscillating around 3%. It is worth noting that this was only possible thanks to the intervention of the Bank of Algeria through the application of a model of exchange rate determination. The latter determines the price of the dinar by the play of supply and demand on the interbank foreign exchange market. However, since the Bank of Algeria has a near-monopoly on currencies (the primary banks have only a negligible contribution in foreign currency), this interbank market cannot be considered as efficient. This quasi-monopoly resulted in the remoteness of the exchange rate from its equilibrium level. This remoteness can lead to an overvaluation of the exchange rate. The dinar thus calculated in relation to other currencies shall be overvalued. As a result, imported products will be offered at prices below their real values, enabling a large proportion of the population to source imported products that have become cheap. This, in turn, led to the control of inflation during the period of analysis.

An examination of the labor market variables shows that the *labor force participation rate* (x_{23}) would be a reserve army that sends volunteers to the informal, since the sign of this variable is positive. The variable *unemployment rate* (x_{22}) had a negative impact on the informal economy. It is true that the definition adopted by the NOS is that of the International Labor Office (1982), but it is nevertheless a minimum definition since only those registered with ANEP[2] are counted, and those employed informally are not considered unemployed. The negative sign in our case is ambiguous, since either, it may result from a hiring effort on the part of the authorities, or it may be a poor accounting of the real labor force. The impact of the variable *self-employment* (x_{21}) is negative, while a positive sign was expected. This may be because the government's efforts to create micro-enterprises through all aid schemes (ANSEJ, ANDI, CNAC, and ANGEM[3]) have contributed to the decline of the informal economy. It should be noted, however, that the State should not be satisfied with this short-term solution since the small size of the undertakings created could ultimately condemn them to closure if rules of fair competition in the economic circuit are not guaranteed.

4. Conclusion

[2] ANEP: National Agency for Public Employment.

[3] ANSEJ: National Youth Employment Support Agency, ANDI: National Agency for the Development of Investment, CNAC: National Unemployment Insurance Fund, ANGEM: National Agency for Micro Credit Management.

The approach developed in this article should be considered as a macroeconomic estimation method, which gives only an order of magnitude and a trend of the informal economy. One of the strengths of PLS-PM modeling lies in the fact that it offers the possibility of segmentation of the causal variables in order to evaluate separately the effects on the endogenous latent variable under study. As a result, the viewpoint that confines the informal economy to a large number of marginalized people who cannot fit into a formal and rigid labor market is no longer sustainable. Our empirical contribution has also made it possible to highlight the responsibility of government intervention in the expansion of the informal economy. Our results suggest why and how more equitable linkages between the government intervention and labor market should be promoted through an appropriate policy and regulatory environment. Our study shows that: "*Labor market impact*" contributes to '51.34%' and the "*Governmental intervention impact*" contributes to '48.65%' in the informal economy in Algeria. This suggests that efforts to absorb the informal economy should simultaneously involve both groups of variables. Nevertheless, it must be acknowledged that the reality is quite different, since governmental institutions dictate economic policies. These institutions can easily ignore the efficiency required from them, and concentrate their efforts to reduce the size of the informal economy only through the labor market block.

The results of our study showed that the observed reversal of the expansionary trend of the informal economy onwards 2010, may not be sustained if the State does not make real efforts to control the macroeconomic factors that most affect the informal economy. This includes the tax burden, which should certainly be more efficient. While it seems legitimate to enlarge the tax bases, the State should ensure that the tax recovery equation is adjusted, so that the tax burden does not become a handicap for the expansion of the companies that are more likely to create added value. An effort should also be made to manage and reduce budget deficits, and to better control the imports. The aim is to set up a system of control that is fundamentally different from the previous ones, capable of protecting the already vulnerable national industry. All these measures could be perceived as a strong signal sent by the government to the economic operators, who will then have a better visibility that should pay off in the future. Indeed, long-term investments can be expected to contribute to the long-term sustainability of Algeria's economic growth and, consequently, to reduce the size of the informal economy on a sustainable basis. However, this will be possible if and only if the government promotes an appropriate policy and regulatory environment.

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