

Shadow Economy and Poverty in Algeria: Evidence from Empirical Study

Mayache Nesrine ^{1,*}

¹ University of 8 May 1945 Guelma (Algeria)

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Summary: This study attempts to investigate the relationship between shadow economy and poverty by designing the mechanism through which shadow economy affects poverty via its impacts on economic growth. The results suggest that increasing the shadow economy leads to increase poverty in developing countries. So time series of data collected for Algeria from 1991 to 2015 in order to examine this relationship. To reach this target, GMM model was used with one-interaction. The findings of the study show that both of economic growth and the shadow economy have weakly impact on poverty statistically negative and significant. This result is mainly explained by the inefficient of public investment and the size of government consumption.

Keywords: Shadow Economy ; Poverty ; Economic Growth ; GMM Model.

Jel Classification Codes : O17; I32 ; C51

* Corresponding author, e-mail: mayache.n@yahoo.com.

I- Introduction :

Poverty reduction constitutes a fundamental target of the Millennium Development Goals among the eight goals. Since 2000, nearly all heads of states agreed that fighting poverty is considered as the first goal, and reaffirmed achieving equity in the distribution of wealth is the foundation of sustainable development. The issue is subjected to the rareness of financial resources insight to finance the poverty alleviation measures especially in low country income. In the other side, there is a few economic phenomena that absorb a significant portion of resources among them is the hidden economy or shadow economy. The last is rated as obsession for government through tax evasion, tax avoidance, and inefficient fiscal authorities and public investments.

In this context, Algeria has been adopted different measures and mechanisms through the issuance of regulatory decrees and legislation in order to eradicate the poverty. At mean time, the national economy is characterized by deepening the shadow economy, which would make out the policy of fighting poverty ineffective. However, the shadow economy is in a close relationship between group of variables like government size, economic growth and fiscal policy that in turn affect poverty.

Research problem

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

Does an increasing in the shadow economy lead to increase poverty significantly in Algeria over the period 1991-2015?

Research Hypotheses

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

Increasing the shadow economy leads to increase poverty significantly in Algeria over the period 1990-2015.

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 poverty;
- To analyze the interactions between shadow economy, economic growth and poverty;
- To investigate a significant relationship between shadow economy and poverty in Algeria;
- To suggest a set of implications and policies that focus on making mechanisms more efficient in fighting the poverty.

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 by the use of GMM approach for Algeria from 1991 to 2015 to draw results discussion and recommendations.

Previous studies

A review of studies by a number of scholars reveals that an increase in the size of the shadow economy affects poverty by reducing state incomes through which governments finance poverty reduction and social protection measures. Among others, their studies are directly linked to the level of country income; and suggest that the country of upper income leads to decrease the level of shadow economy. Although the concept of shadow economy has been grown, it proved useful to many policy makers and researchers. This is because of the capture and share large workforce

Several studies confirm the persistence of high rates of informal employment and poverty in Latin America (Perry & al, 2007; Worldbank, 2006). However, research about the connection between informality and poverty is insufficient. Analyses of poverty dynamics are usually concerned with patterns and determinants of transitions and persistence. In general, results are that movements in and out of poverty are frequently associated with changes in employment status. Gasparini and Tornaroli (2007) found that on average the difference in the poverty headcount ratio between informal and formal workers is around 4 times in the region¹.

Unlike Obayelu & Larry (2007) in a comparative analysis of the relationship between poverty and shadow economy data of 145 countries found that the variables have no geographical boundary. The incidences of poverty and shadow economy are larger in the poor, developing and transition, countries when compared with the highly developed countries. There is also a causal link between poverty and shadow economy especially in the developing and transition countries².

Meanwhile, Beccaria & Groisman (2008) explored if shadow economy is the main cause of Argentinean poverty and find that, although relevant, the later one is not limited to households with members working in the informal sector³.

On the contrary, Williams (2014) tried to understand whether the informal economy helps those who are poor to escape their poverty, this report reviews the evidence on the size of the informal economy, who participates in and benefits from informal work as well as what type of work they do and why. It then evaluates how the informal economy might be tackled in a way that helps people who are poor to escape their poverty⁴.

Huynh & Nguyen (2019) supported the idea of Williams' study, and they examined the impact of shadow economy on income inequality by using a panel data set of 19 Asian countries in the period 1990–2015. In contrast to previous studies, the results from estimations of fixed effect and random effect surprisingly show that the shadow economy reduces income inequality in the research region. Specifically, the shadow economy significantly increases the income share held by lowest quintile and decreases the income share held by highest quintile. The result can be explained by combining the three schools of thought on informal economy including Dualism, Legalism, and Volutarism. The finding contributes to the idea that the shadow economy is not always bad, especially to the poor, out of its negative effects. Therefore, policies to deal with the shadow economy should take the poor into close consideration with other simultaneous solutions for poverty eradication and income inequality reduction in developing countries⁵.

However, Berdiew & al (2020) investigated whether the poverty affects the size of shadow economy using cross-country panel data for over 100 countries for the period 1991–2015. The results show that poverty has a positive and significant effect on the size of the shadow economy. Furthermore, we argue that the quality and size of governmental institutions matter in moderating the impact of poverty on the shadow economy. Considering the interactions between poverty and government quality and size, we find that poverty has the largest effect on the size of the shadow economy when government quality is the lowest and the size of the government is the largest. These results withstand a battery of robustness checks⁶.

From the brief presentation of the previous studies, they concluded a causal relationship by only comparison of shadow economy and poverty 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 through which shadow economy influences poverty. Hence, the actual study takes into account the critics mentioned before. It concerns only the national economy to explore relationship between shadow economy and poverty by drawing the mechanism how influences are interpreted. To reach this goal, we have used an appropriate method to define the interactions which is the GMM approach. So, we relied in this study on a set of instruments variables selected in proportion to what characterizes the local economy. Finally, the time series data seems the most recent with

comparison of previous studies for reason the lack and difficult of obtaining data especially those related to shadow economy.

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: Underground production 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 reasons⁷:

- 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 (2010) identifies four key causes of the shadow economy⁸:

- 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 follows⁹:

- 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 Structuralist school sees the informal economy as subordinated economic units (micro-enterprises) and workers that serve to reduce input and labour 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 Voluntarist 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.

Each school of thought subscribes to a different causal theory of what gives rise to the informal economy as follow¹⁰:

- The Dualists argue that informal operators are excluded from modern economic opportunities due to imbalances between the growth rates of the population and of modern industrial employment, and a mismatch between people’s skills and the structure of modern economic opportunities.
- The Structuralists argue that the nature of capitalism/capitalist growth drives informality: specifically, the attempts by formal firms to reduce labor costs and increase competitiveness and the reaction of formal firms to the power of organized labor, state regulation of the economy (notably, taxes and social legislation); to global competition; and to the process of

industrialization (notably, off-shore industries, subcontracting chains, and flexible specialization).

- The Legalists argue that a hostile legal system leads the self-employed to operate informally with their own informal extra-legal norms.
- The Voluntarists argue that informal operators choose to operate informally after weighing the costs benefits of informality relative to formality.

The dominant schools of thought have different perspectives on this topic, although some do not explicitly distinguish between the two or adequately deal with both.

- The Dualists subscribe to the notion that informal units and activities have few linkages to the formal economy but, rather, operate as a distinct separate sector of the economy and that the informal workforce assumed to be largely self-employed comprise the less advantaged sector of a dualistic or segmented labor market. They pay relatively little attention to the links between informal enterprises and government regulations. But they recommend that governments should create more jobs and provide credit and business development services to informal operators, as well as basic infrastructure and social services to their families.
- The Structuralists see the informal and formal economies as intrinsically linked. They see both informal enterprises and informal wage workers as subordinated to the interests of capitalist development, providing cheap goods and services. They argue that governments should address the unequal relationship between “big business” and subordinated producers and workers by regulating both commercial and employment relationships.
- The Legalists focus on informal enterprises and the formal regulatory environment to the relative neglect of informal wage workers and the formal economy per se. But they acknowledge that formal firms what De Soto calls “mercantilist” interests collude with government to set the bureaucratic “rules of the game” (De Soto 1989). They argue that governments should introduce simplified bureaucratic procedures to encourage informal enterprises to register and extend legal property rights for the assets held by informal operators in order to unleash their productive potential and convert their assets into real capital.
- The Voluntarists pay relatively little attention to the economic linkages between informal enterprises and formal firms but subscribe to the notion that informal enterprises create unfair competition for formal enterprises because they avoid formal regulations, taxes, and other costs of production. They argue that informal enterprises should be brought under the formal regulatory environment in order to increase the tax base and reduce the unfair competition to formal businesses.

2. Relationship between Shadow Economy and Economic Growth:

According to the researchers and policy makers that economic growth is the most important determinant and the necessary condition for poverty reduction. Although, economic growth does not necessarily imply development, however, significant and sustainable growth rates can provide the resources that societies need to combat poverty and high levels of deprivation and achieve improvements in the human condition. Many empirical studies have found the economic growth as pivot poverty reduction subjected to different explanatory variables like studies done by Ravallion & Chen (1997), Gupta & all (1998), White & Anderson (2001), Dollar & Kraay (2002), and Permia (2003)¹¹.

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 repression¹².

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 model¹³.

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 stabilization¹⁴.

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 growth¹⁵.

As Friedrich Schneider and 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 deterrents and economic underdevelopment¹⁶.

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 a 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 development¹⁷.

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 form¹⁸.

II– Methods and Materials:

1. Model Specifications

Since economic growth affects on shadow economy and all together have impacts on poverty, this study specifies the model using one-way interaction between shadow economy and economic growth. In the formula (1), Y is the response variable, X the predictor (independent) variable with Z being the moderator variable. The term XZ is the interaction of the predictor with the moderator.

$$Y = \alpha + \beta_1 X_i + \beta_2 Z_i + \beta_3 X_i Z_i \dots\dots\dots (1)$$

Where:

Y: logarithm of poverty;

X: logarithm of shadow economy;

Z: logarithm of economic growth;

XZ: is the interaction term of shadow economy and economic growth
log(log(shadow)*log(economic growth))

The GMM system is operated when adding a set of conditioning variables or instruments list. Hence, the formula (1) can be written as the follow:

$$Y = \alpha + \beta_1 X_i + \beta_2 Z_i + \beta_3 X_i Z_i + \delta W_i + e_i \dots\dots\dots (2)$$

Where e_i is the error term and W_i is list of instruments variables.

2. Variables Introduction and Data

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. The collected data set for Algeria are obtained from Global Economy site over the period 1991-2015 which is considered as the latest data .

We have used Human Poverty Index (HPI) to express the poverty. It is discarded income in the variable mix and included only “the most basic dimensions of deprivation: a short life, lack of basic education, and lack of access to public and private resources” (Doraid, 1997 :).

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.

Whereas the economic growth represents in the real gross domestic production (GDP), and the instruments list consists two variables which are the public investment (W_1) and the government consumption (W_2). Both of them are expressed en percentage of GDP. This choice of instruments list related to realty of the national economy that the increasing of government consumption and the

insufficient public investment lead to decrease in economic growth. This is apparent when public administration is corrupt and money misused. So, the formula (2) expresses as follow:

$$Y = \alpha + \beta_1 X_i + \beta_2 Z_i + \beta_3 X_i Z_i + \delta_1 W_1 + \delta_2 W_2 + e_i \dots\dots\dots (3)$$

The figure (1) demonstrates the evolution of these variables they are converted into natural logarithms. The basic note is that the shadow economy (X), public investment (W_1) and the government consumption (W_2) develop together linearly. Whilst the economic growth (Z) is growing independently, the poverty (Y) is nearly steady.

II- Results and discussion :

1. Characteristics of Sample Data

The table (1) recaps characteristics of sample data collected from 1991 to 2015. These characteristics combine mainly the mean, the median and the standard deviation; and its evaluations differ from variable to another. Whereas the kurtosis coefficient is upper than 1 in all variable that interpret the leptokurtic shape. In the other side the skewness coefficient once is positively-skewed or right skewed for shadow economy, economic growth and government consumption; or denotes negatively-skewed means left skewed for the rest of variables. Similarly all variables have not the normal distribution, the probabilities are upper than 5%.

2. Stationary test of variables

The ADF was applied to data series and the results are reported in table (2). It shows that the variables are non-stationary in levels, but they become stationary after taking the first difference for economic growth, public investment; and taking the second difference for human index of poverty, shadow economy, and government consumption. The results are significant at 1% or 5% or 10%.

3. Estimation of GMM model

Testing empirically the relationship between shadow economy and poverty, a one-way interaction model is considered. The estimates of relationship between poverty and shadow economy for Algeria are presented in table (3) which its columns present different specifications. In the model the variables of interest are shadow economy, economic growth; and the interaction term between shadow economy and economic growth appeared statistically significant. On both specifications, the coefficients of shadow economy and economic growth are negative and significant at 5% level; indicating that increasing in their amount lead to decrease in the poverty. While the term of interaction seems positive and significant at 5% level, in the meaning that raising of 1% results 0.04% augmentation of poverty. The coefficient of government consumption is negative, but it is not statistically significant level. This negative effect indicates that increasing government consumption on social services such as health and education could benefit the poor around 0.003%. Unlike, public investment has a positive significant impact boosting the poverty approximately 0.05%.

4. Robustness check

The diagnostic tests presented in figure (2) summarize that there is no evidence of residual serial correlation probabilities are above 5% which means reject of null hypothesis. Measuring the explanatory power of the model by their adjusted R squared proxy 99.45% of the variation in the poverty can be explained. For the presence of AR(1), heteroskedasticity test confirm absolutely that

the errors are white noise. Furthermore, the figure (3) illustrates the normality test of residuals which reach 13.094 with probability value proxy 0.0014 lower than 5%. This means the acceptance of the null hypothesis that the residuals track the normal distribution. Test of instruments valid should be performed; the result is shown in table (4). The interpretation is accepting null hypothesis the validity of instruments (the probability 0.2044 upper than 5%). To conclude the whole of the running model is accepted econometric and statistically.

5. Discussion

The main conclusion that can be drawn from this study is that shadow economy has a negative significant effect on poverty. It contributes to reduce poverty proximately 0.44%, while the raise of economic growth contributes to breakdown poverty by 0.14%. The basic note that this effect appears is powerless. The inefficiency of public investment redounds greatly to explain the surprisingly result, it contributes number of employments opportunities create by informal economy. In the other hand, increased government size expressed in government consumption may distort the economic and political environment and crowd out private sector investments through investment in physical and human capital infrastructures such as education and health; the government may contribute to development of private sector. This argument is especially valid whereas government consumption leads to decrease the poverty by 0.003%. This result is associated with inefficiency of public investment that makes general conclusion which government unable enhances general welfare. Several empirical studies consistent with result obtained such as Ram (1986), Aschauer (1989), Dowrick (1996), Sanchez-Robles (1998), Fan and Rao (2003), Esfahani and Ramires (2003), and Higgins & al (2009).

IV- Conclusion:

This paper assesses the relationship between poverty and shadow economy for Algeria from 1991 to 2015. The main purpose is to design the mechanism through which shadow economy affects poverty via its impacts on economic growth by the use of an appropriate model the GMM model. The findings of the study show that both of economic growth and the shadow economy have weakly impact on poverty statistically negative and significant. This result is mainly explained by the inefficiency of public investment and the size of government consumption.

According to the empirical results, the null hypothesis is rejected that increasing in shadow economy by 1% leads to decrease in poverty by 0.44%; and this rate seems too weak. The government could thus be misled and choose inadequate policies reflected their ineffectiveness in the fight against poverty.

In fact, as the results show, shadow economy cannot increase social welfare poor in Algeria, in order to raise the necessary resources for financing the key of development tasks; the government needs to overcome shadow economy by its integration in the formal economy. Government can reduce this menace by engaging itself in sustainable poverty reduction activities, tax policy changing, embarking anti-corruption and increase in jobs opportunities within the formal economy.

In terms of further studies, one may include governance indicators, therefore better governance reduces poverty in different dimensions including empowerment, capabilities, opportunities, and security. The poor can influence policy making, budget priorities, and program designing through participating in political and administrative processes.

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Appendices :**Table (1) : Characteristics of Sample Data**

	Y	X	Z	XZ	W ₁	W ₂
Mean	-0.402812	3.413674	7.698698	26.21744	2.768327	3.489504
Median	-0.391562	3.388450	7.390064	26.72078	2.781920	3.431080
Maximum	-0.286350	3.660480	8.629132	28.47595	3.070840	3.927503
Minimum	-0.541285	3.177220	6.304723	22.40828	2.418589	3.111291
Std. Dev	0.085981	0.181461	0.605599	1.619580	0.179655	0.216773
Skewness	-0.175735	0.054078	0.215368	-0.795508	-0.326321	0.338225
Kurtosis	1.623332	1.328248	2.491274	2.777252	2.468696	2.333848
Jarque Berra	2.102861	2.923388	0.462849	2.688490	0.737736	0.938900
Probabality	0.349438	0.231843	0.793403	0.260797	0.69517	0.625346
Sum	-10.07031	85.34186	192.4675	655.4359	69.20818	87.23759
Sum Sq.Dev	0.177424	0.790270	8.802005	62.95297	0.774621	1.127774
observation	25	25	25	25	25	25

The source : Outputs, Eviews.10.

Table (2) : ADF Test for variables

Variables	Models	At Level	1 st Difference	2 nd Difference
y	intercept	-1.7466 (0.3963)	-3.174098 (0.0349)	-4.638777 (0.0016)
	Trend & intercept	0.4977 (0.9986)	-3.537750 (0.0587)	-5.086173 (0.0031)
	none	-11.853 (0.0000)	-0.791841 (0.3615)	-8.261824 (0.0000)
X	intercept	-0.1155 (0.9369)	-2.929024 (0.0574)	-7.385451 (0.0000)
	Trend & intercept	-3.8239 (0.0380)	-2.878202 (0.1868)	-7.230025 (0.0000)
	none	-1.7105 (0.0822)	-2.601365 (0.0118)	-7.454088 (0.0000)
Z	intercept	-2.3891 (0.1550)	-6.872473 (0.0000)	/
	Trend & intercept	-3.0650 (0.1366)	-6.659489 (0.0001)	/
	none	1.0130 (0.9128)	-6.953254 (0.0000)	/
W ₁	intercept	-0.3402 (0.9046)	-4.525792 (0.0019)	/
	Trend & intercept	-2.4114 (0.3645)	-5.057433 (0.0028)	/
	none	0.8550 (0.8884)	-4.514645 (0.0001)	/
W ₂	intercept	-1.5091 (0.5112)	-3.278941 (0.0280)	-5.467513 (0.0002)
	Trend & intercept	-0.9521 (0.9324)	-3.370646 (0.0802)	-5.383435 (0.0014)
	none	0.7234 (0.8645)	-3.313575 (0.0020)	-5.603536 (0.0000)

The source : Outputs, Eviews.10.

Table (3) : Estimation GMM Model

Dependent Variable Y= log(HPI)				
Variable	coefficient	Std-Error	t-statistic	Prob.
C	1.300673	0.576819	2.254908	0.0376**
X	-0.444104	0.155955	-2.847060	0.0111**
Z	-0.145026	0.0553320	-2.621019	0.0179**
XZ	0.041179	0.015838	2.600049	0.0187**
W ₁	0.052014	0.022074	2.356323	0.0307**
W ₂	-0.003967	0.011083	-0.357907	0.7248
AR(1)	0.968212	0.016313	59.06248	0.0000**
R- Squared	0.995954	Mean Dependent VAR		-0.397043
Adjusted R-Squared	0.994526	S.D. dependent VAR		0.082739
S.E of regression	0.006121	Sum Squared resid		0.000637
Durbin –Watson Test	1.531656	J-Statistic		3.174931
Instruments rank	9	Prob (J-Statistic)		0.204443

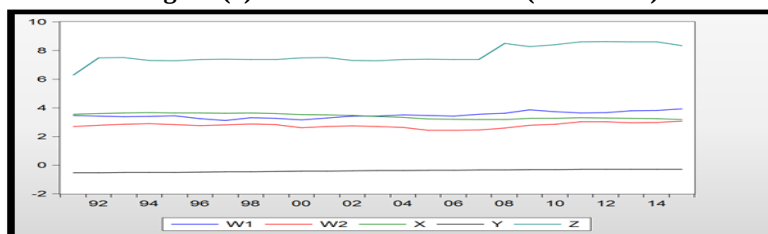
The source : Outputs, Eviews.10.

Note: ** Significant at the 5 percent level

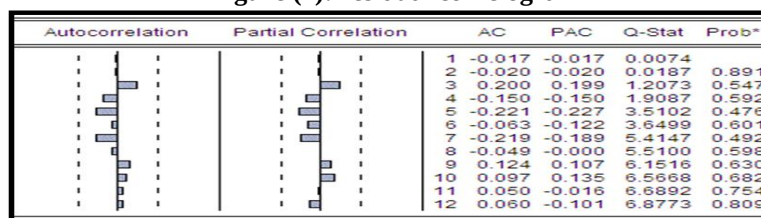
Table (4) : Instruments Valid Test

Null hypothesis is W ₁ W ₂ valid instruments			
Difference in J-statistic	value	df	Probability
	3.174931	2	0.2044

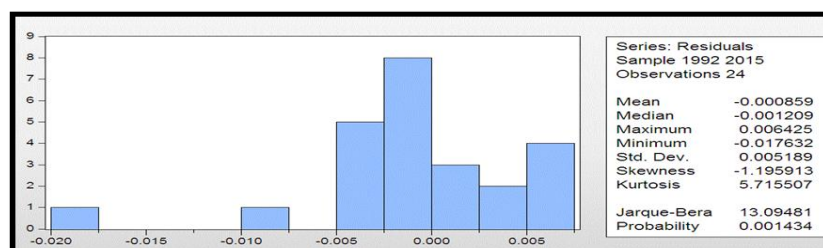
The source : Outputs, Eviews.10.

Figure (1): Evolution of variables (1991-2015)

The source : Outputs, Eviews.10.

Figure (2): residual correlogram

The source : Outputs, Eviews.10

Figure (3): test of Normality

The source : Outputs, Eviews.10

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