Oil Price Fluctuations and Employment in Algeria

تقلبات أسعار النفط والعمالة في الجزائر

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ملخص:

تهدف هذه الدراسة إلى تحليل العلاقة بين تقلبات أسعار النفط و مستوى العمالة في الاقتصاد الجزائري من خل الأخذ بيانات سنوية تغطي الفترة من 1985 إلى 2017. اعتمادا على نموذج الانحدار الذاتي (VAR) متبوعا بوظائف الاستجابة النبضية تحليلا لتباين و اختبار Granger للسببية. تؤكد النتائج المتوصل إليها أن هناك علاقة قوية و إيجابية بين العمالة، زيادة أسعار النفط و النمو الاقتصادي في الجزائر.

الكلمات المفتاحية: سعر النفط، العمالة، الناتج الداخلي الخام، نموذج الانحدار الذاتي، الجزائر.

تصنيف JEL: E24 , Q43

Abstract:

The present study aims to analysis the relationship between oil price fluctuations and employment level in Algerian economy by taking annual data covering the period 1985 to 2017. We use the Vector Autoregression analysis followed by impulse response functions, variation decomposition and Granger causality test. Our results confirm that there is a strong and positive relationship between employment, increasing oil price and economic growth in Algeria.

Key words: Oil Price, Employment, Gross Domestic Product, Vector Autoregression model, Algeria.
Jel Classification Codes: E24, Q43.

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Introduction:

Oil is one of the most important economic resources that enhance the effectiveness of economic activities between countries. Where the official figures show that, the developments in world oil markets over the past century have given a great boost to industry, economic growth and even employment of the world level. However, the instability that characterizes oil markets in many times can have extensions and different effects especially for oil-exporting countries.

Algeria is one of a developing country that relies heavily on the oil price and oil export revenues to finance the economy, where oil revenues play strategic role in the structure of the Algerian economy, which represents more than 95% of total export and on average 60% of government revenues in annual budgets. This situation has made the Algerian economy vulnerable to shocks in global oil markets, which had a tremendous effect in many times on the structure of the economy and various economic sectors such as the labor market. Where unemployment in an oil-exporting country such as Algeria, is expected to rise in times of crisis because of its heavy reliance on oil revenues.

Problematic: In this study, we try answer the Following question:

What is the nature of the relationship between oil prices fluctuations and employment in the Algerian economy?

Hypothesis: To reply to the problematic, we assume this Hypothesis:

H_0: Oil price fluctuations have positive impact on employment level in Algeria.
H_1: Oil price fluctuations have negative impact on employment level in Algeria.
H_0: There is a positive relationship between gross domestic product and employment level in Algeria.
H_1: There is a negative relationship between gross domestic product and employment level in Algeria.

Subject Importance: The importance of this study lies in the fact that it discusses one of the biggest problems faced by the Algerian government. Hence, the objective of this study is to analyze the relationship between oil price fluctuations and employment. To try to understand whether oil price fluctuations have an impact on employment in the Algerian economy. Such understanding or finding will help to policy makers in Algeria to establish a better employment policy.

Literature Review: The relationship between oil prices and employment has attracted several studies in the empirical literature, especially for industrialized countries. For in a pioneer work, (Hamilton, 1983) examined the impact of oil price shocks, on the US economy using the Granger causality test from 1949 to 1972. He found that oil price changes is significantly causing to GNP and unemployment. An extension so, other researchers have relied basic findings obtained by Hamilton for development of many other studies, for example (Burbidge & Alan , 1984), (Gisser & Thomas , 1986).

Another study, presented by (Steven, 2001) studying the effect of oil price shocks on the jobs creation in the U.S. manufacturing sector during the period of 1972 to 1988. The empirical evidence suggests that oil shocks account for 20–25 percent of the variability in employment growth. Where jobs creation increasing as an oil prices increase rises (in magnitude) with capital intensity, energy intensity and product durability.

(Papapetrou, 2001) analysed the dynamic relationship between oil price changes, economic activity and employment in Greece, using a multivariate vector-autoregression VAR approach. The study concluded that oil price fluctuations affect real economic activity

and employment. (Chang & Joon , 2003) analysed the effect of an oil price shock on the Singapore economy using quarterly data spans from the first quarter of 1978 to the third quarter of 2000. Four variables had been used in this study namely oil prices, GDP, CPI and unemployment rates. The results denote there is a marginal impact of an oil price shock on the Singapore economy.

(Doğrul & Ugur , 2010) examined the dynamic relationship between oil prices, interest rate, and unemployment in emerging market (the case of Turkey) using a monthly data for a period of 2005-2009. This study applied Toda-Yamamoto causality test. The empirical analysis suggests that the real price of oil and interest rate improve the forecasts of unemployment in long run. Another recent related study by (Alkhateeb, Haider , Zafar , & Nawaz , 2017) investigated the relationship between oil price and employment in Saudi Arabia during the period of 1980-2015. The study by using a linear and non-linear ARDL models found that increasing oil price will be positively effect of employment more than declining employment due to fall in oil price, as well in his study of the Turkish economy.

In addition, the study of (Altay, Mert , & Ebru , 2013) found long run relationship between oil Price, output and employment in Turkey over the period 2000:1-2012:4 by applying Vector Error Correction Methodology. (Trang, Tran , & Dinh , 2017) investigated the impact of oil prices on some macroeconomic variables, namely: growth, inflation unemployment and budget deficit in Vietnam by Applying a Vector Auto Regression model using annual data covering the period from 2000 to 2015. The study finds that increasing in oil prices would lead to higher inflation and budget deficit in Vietnam. While its impacts on the gross domestic product growth and unemployment are not clear.

For the case of Algeria, some studies have been conducted for the impact of oil price shocks on economic activity in general. In contrast, there have been no studies discussing the relationship between oil price shocks and employment particularly. For example, the study of (Laourari & Gasmi, 2016) analyzed the effect of revenues fluctuations on economic growth in Algeria from 1960 to 2015.The study concluded that there is a negative effects of fluctuations in oil price revenues on economic and industrial growth in Algeria. (Benramdane, 2017) investigated the relationship between oil price volatility and economic growth in Algeria over the period 1970-2012. She found that the negative growth effects of oil price volatility offset the positive impact of oil boom. In addition, (Djebbouri, 2018) concluded that there is a negative relationship between oil prices and the exchange rate in the Algerian economy.

I- Theoretical background:

Theoretical literature shows that there is no unified theory linking oil price fluctuations to employment directly. However, the relationship between oil price fluctuations and employment has been well documented and comprehensively in the empirical literature. Most studies have found that, the relationship exists although they were different among countries. In general, we can discuss the impact of oil price shocks on employment in three scenarios.

I-1- First scenario: the supply side effect: According to this scenario, oil is considered as the basic input of the production. Hence, any increase in oil prices translate to higher output costs resulting leading to commodity price increases which in turn, results in a decrease in output levels, a fall in employment and ultimately an increase in the unemployment rate because lower demand for goods and services(Ahmad, 2013, p. 44).

I-2- Second scenario: demand side effect: This scenario postulates that the impact of oil prices on employment are transmitted through the adverse impact of the consumption and investment channels (Ahmad, 2013, p. 44) where capital considered as the basic input of the production in this scenario, which comes from local and foreign investments. According to this, any rise in oil prices will lead to higher interest rates (the cost of borrowing). This rise in interest rate into higher cost of borrowing for investors (Sibanda, Mishi, & Tsegaye , 2015, p. 289)resulting in a decline in production and economic activities. Because investors withdraw their investments and take money out of the country and invest in higher profitable and

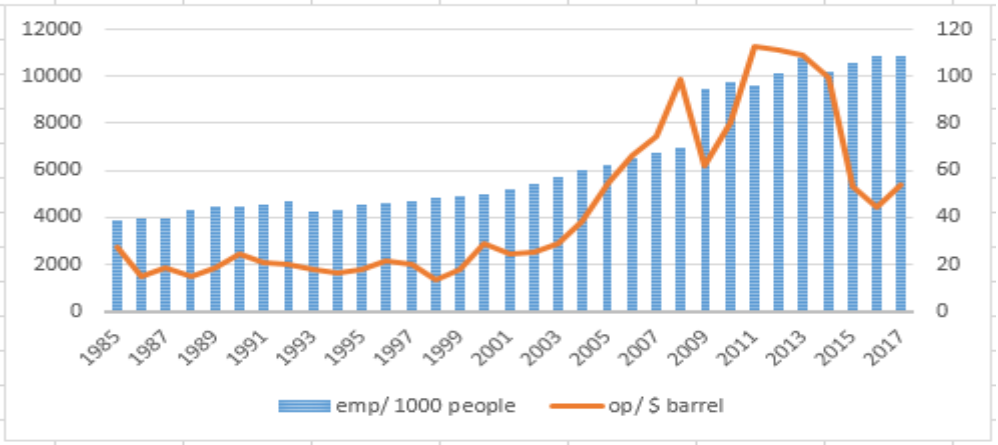
growing economies (Brown & Mine , 2002, p. 195)which eventually leads to drop in the level of employment in the country.

I-3- Third scenario: wealth transfer effect: This scenario explains the impact of oil prices on employment through the basic emphasis is on the transfer of wealth to oil exporting countries in the form of oil payments(Brown & Mine , 2002, p. 195).In addition, oil price shocks are projected to pose economic uncertainty on the future performance of the macro economy(Ben, Awujola , & Ogwuche , 2016, p. 138).In particular for the countries that heavily dependent on oil revenues. Where any decline in oil revenues is expected to lead to a decline in consumption, spending and investment, especially if the government or people decide to postpone consumption or investment decisions until they see an improvement in the economic situation (Ben, Awujola , & Ogwuche , 2016, p. 138).Which will result in a decline in the economic performance of the country, including a decline in demand for labor. This could apply to the case of developing oil-exporting countries such as Algeria.

II- Overview of oil prices and employment in Algeria:

In this section, we will try to explore the trends of both oil prices and employment in the Algerian economy. Figure 01 below shows oil price fluctuations and employment trends in Algeria for the period 1985-2017. According to this, the annual development of oil prices shows a significant decline during this period 1985-1999. Where, the average annual price moved from 27.6 $ /barrel in 1985 to 14.4 $ /barrel in 1986. Since then, the prices of oil barrels have begun to lower from 17 $ /barrel in 1993 to 13 $ /barrel in 1998 then 18 $ /barrel in 1999. This decline in prices can be explained by the oil shock that faced the world beginning in 1986.

Figure n°1: Oil Prices and employment in Algeria 1985-2017



Source: Drawn by the Author from OAPEC Database and ONS.

On the other hand, total of employment during the same period has increased by 1021 thousand people; from 3877 thousand people in 1985 to 4898 thousand people in 1999. However, this rise in the level of employment was not sufficient, which are confirmed by high unemployment rates. Where Algeria faced a growing problem of unemployment starting of 1986 where the rate of unemployment jump from 11.4% in 1986 to reaching the highest level in 1999 to 30%. Stay the major causes, why unemployment rates are high to the structural factors, which affected the Algerian economy since the beginning of the oil crisis.

Begin in 2000s, oil prices were characterized by some stability. World demand for oil has risen significantly after demand rise from China, India and other emerging countries. Prices rose from $ 28.5 per barrel in 2000 to over $ 97 per barrel in 2008 due to limited supply of oil relative to demand. Despite some decline between 2009 and 2010 oil prices have steadily increased to over 100 $ /barrel during the years 2011 to 2013. Nevertheless, by the end of 2013 prices had again fallen to below 99 $ /barrel in 2014 and continued to fall to 54 $

/barrel in 2017. As for employment, their indicators have improved during this period compared to the previous period. According to this, the total of employment has increased from 4977 thousand people in 2000 to 10859 thousand people in 2017 which led to a drop in unemployment rates significantly. Where it decreased to 17.7% in 2000 and continued to fall to reach minimum level of 9.8% in 2013.

III. Methods and Materials:

To achieve the objective of the study and based on what has been discussed in the previous sections, this paper uses a model consisting of three variables covering the period 1986-2017.The variables uses in the study include, Total employment, oil prices and real gross domestic product. The data was obtained from several sources. Employment and gross domestic product data was obtained from ONS. While oil prices data was obtained from Organisation of Arab Petroleum Exporting Countries (See Appendix n°1).

For the econometric study, this paper employed a dynamic model for investigate relationship between oil price fluctuations and employment represented by the Vector Auto regression (VAR) approach. This model introduced for the first time by Sims (1980) as an alternative estimation strategy for structural models (Enders, 2015, p. 290). Where many studies used this model for investigate the link between oil price shocks and some macroeconomic variables for example (Reza & Markwardt , 2008), (Löschel & Ulrich, 2009), (Du, Yanan, & Chu , 2010)... In general, the VAR model can be presented through the following equation:

$$Xt = A0 + A1\,Xt - 1 + A2\,Xt - 2 + \ldots + Ap\,Xt - p + e_t \qquad (1)$$

Where:
X_t: Vector containing each of the n variables included in the VAR;
A_0: vector of intercept terms;
A_i: matrices of coefficients;
e_t: vector of error terms.

According to this, we can write the vector of endogenous variables in the VAR model for our study as shown by the equation (2). We note here that certain arrangements have been made for the variables in the model to ensure achieve stability:

$$Xt = (EMPt, OPt, GDPt) \quad (2)$$

Where EMP represents employment (thousands of people), OP: oil prices on dollars /barrel and GDP: gross domestic product at constant prices. To determine the shocks analysis, VAR model provides a range of important applications that take into account the impact of random shocks in the past and present, mainly represented in the impulse response functions (IRFs), variation decomposition (VDCs). In addition, the Granger test for causality. All of these tests will be applied in our study.

IV- Results and Discussion:

IV-1- Initial Inspection:

Appendix 02 presents a summary of the descriptive statistics of the data used in the study. Over the period, the average total employment in the economy is 8.70 thousand of people. While the average price of oil 3.53 dollars and the average of real GDP figure is 10.75 million during the same period. In addition to, the mean figures, standard deviation for each variable was also reported.

On the other hand, appendix 03 shows ADF test results for stationarity. This test aims to examine the time series properties of the variables under consideration. To provide evidence

as to whether the variables are stationary in the level or the first difference. The results show all variables become stationary after first difference under the 5% significance level.

IV-2- Establishment of VAR Model:

According to Sims methodology, the optimal lag should be select when a VAR model is established. For this, there are many criteria to select the optimal lag length. Appendix 04 reports the VAR lag order selection criteria, and it indicates that lag (1) as optimal based on the SC and HQ. Moreover, the results of autocorrelation test in appendix 05 show that the model did not contain the autocorrelation phenomena when using this lag.

Another important point that should be conducted when estimating VAR model is to test the stability of estimated model. If it isn't, the confidence intervals for impulse response function cannot be built. In this study, the stability of the model was tested with the help of AR root test as graphs. Appendix 06 shows that the VAR model is considered stable, because none of the points exceeds the circle.

IV-3- Granger causality test:

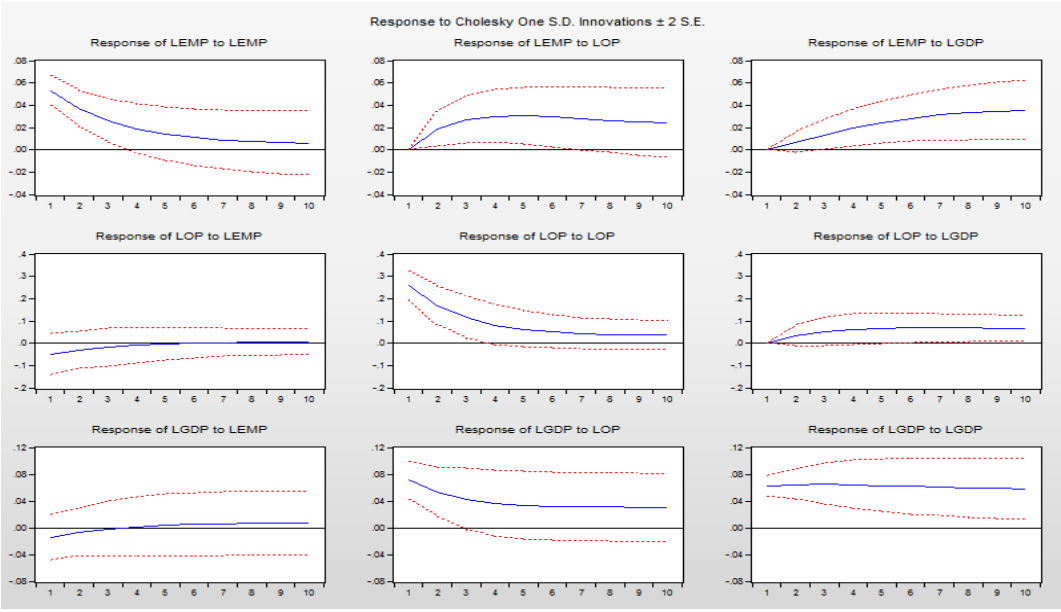
To make the dynamic relationship among employment, oil price and economic growth more clear, we used the Granger causality test. The results are reported in Appendix 07. It reveals that there is unidirectional causality running from oil price to employment as the null hypothesis of no causality is rejected at 5 percent level of significance. In other word, oil price is an important factor to promote the employment in Algeria.

The results also show that there is unidirectional causality between employment and gross domestic product and the causal direction is from economic growth to employment, as the null hypothesis of no causality is rejected at 5 percent level of significance. However, the causal relationship analysis according to Granger is a short run analysis and may not capture clearly the long run dynamics among variables. Therefore, we use innovation accounting (Impulse Response Functions and Variance Decomposition) in the next step, to capture the effects of shocks in variables on employment level in both the short and long run.

IV-4- Impulse response function:

The impulse response function gives the response of one variable to an impulse in another variable in a system that may involve a number of other variables as well. In this study, the results of impulse response function are shown in figure 02.

Figure n°2: Impulse response function



Source: Calculation using Eviews 9

The analysis results of the impulse response functions show that the application of a structural shock to the oil price in the first period did not have any impact on employment.

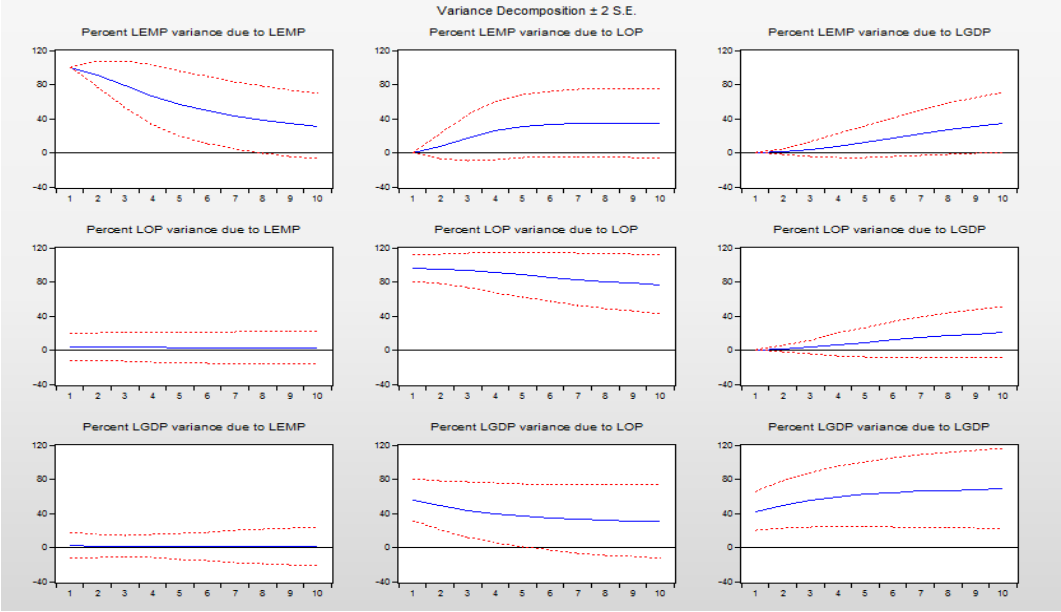
Nevertheless, beginning in the second period we noticed a positive response for employment reached to (1.853%) then (2.693%) and (3.019%) during the second, third and fifth periods respectively. After that, the effect of oil shock began to decline but did not disappear in long run. Where decreased from (2.924%) then (2.643%) to (2.406%) over the horizon period sixth, eighth and tenth respectively.

On the other hand, we also observe that a shock in GDP didn't have any impact on employment in the first period, but become very clear later in other periods. The figure 02 shows that a shock in GDP has a strong positive impact on employment from the second period (0.067%) to the end of the response period (3.559%). These empirical results reflect the reality of the Algerian economy in which oil is an important factor in influencing the country's economic growth and employment policies where Algerian government remains heavily dependent on oil revenues for job creation.

IV-5- Variance decomposition:

Another important application used in VAR model is the variance decomposition, this latter indicates amount of information each variable contributes to the other variables. The results of variance decomposition are given in figure 03. It reveals that in short-term oil price shock has a limited contribution in explaining the variation of employment. For example, in the first period the fluctuation of employment is affected only by itself. While in the second period the fluctuation in employment is explained by approximately (7.55%) of oil shocks and (0.99%) by the GDP innovations only, compared to (91.45%) of its own innovations.

Figure n°3: Variance decomposition



Source: Calculation using Eviews 9

Oppositely, it is noted that the impact of shocks in oil prices on employment will become stronger in long run. Where, the results indicate that over the horizon period of three to ten years, the contribution of oil price shocks and GDP to the explanation of the EMP variation increases significantly moved from (17.43%) to (30.39%) then (34.52%) to (34.37%) during periods three, five, seven and ten respectively for oil price fluctuations versus (3.71%) to (12.72%) then (22.72%) to (34.98%) for GDP during the same periods. These results are consistent with our findings by impulse response functions and suggest that the impact of oil price fluctuations on employment in long-term more than short-term.

V- Conclusion:

This study has tried to explore relationship among oil price and employment level in Algeria using data from 1985 to 2017. To achieve this purpose the study applied the Vector

Autoregression approach using three variables; oil prices, economic growth and total employment. The empirical evidence suggests that a positive shock in the price of oil and economic growth has a positive and strong impact on employment, especially in the long term. In addition, the results found that a unidirectional causality between oil price and employment, this causal effect running from oil price to employment. The empirical results show that the Algerian government should adopt alternative policies to promote economic growth and employment outside the hydrocarbon sector, in order to reduce the absolute dependence on oil revenues for job creation.

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Appendices:

Appendix n°1: Study Database

Years	Employment (1000 people)	Oil prices (dollars per barrel)	gross domestic product (constant prices/millions)
1985	3877	27,56	22710,06
1986	3914	14,633	20565,28433
1987	3968	18,387	20161,57963
1988	4340	15,148	21176,42509
1989	4434	18,561	24466,26087
1990	4478	24,421	26199,81569
1991	4569	20,984	32362,34234
1992	4687	20,036	30635,57013
1993	4273	17,49	28139,18874
1994	4325	16,178	27271,79318
1995	4505	17,423	28323,13462
1996	4641	21,271	30584,65905
1997	4719	19,72	31301,14839
1998	4858	13,072	30350,53292
1999	4898	18,087	33844,03742
2000	4977	28,724	42966,69688
2001	5197	24,718	42271,131
2002	5435	24,838	44590,09465
2003	5741	28,826	49667,33901
2004	5976	38,328	55926,48204
2005	6222	54,587	67838,73957
2006	6517	66,025	74658,86278
2007	6771	74,664	79216,55869
2008	7002	98,6	89346,18003
2009	9472	62,163	76329,82227
2010	9736	80,253	88338,83139
2011	9599	112,897	101699,6123
2012	10170	111,523	104538,536
2013	10788	109,441	103984,3848
2014	10239	99,615	104561,51
2015	10594	52,825	96739,64668
2016	10845	44,206	94756,12412
2017	10859	54,2	97471,77399

Source: Publications of the National Bureau of Statistics (O.N.S) and Database of Organisation of Arab Petroleum Exporting Countries Database.

Appendix n°2: Descriptive statistics of variables

Variables	Number of Observations	Mean	Standard Deviation
EMP	33	8.70	0.36
OP	33	3.53	0.70
GDP	33	10.75	0.58

Source: Calculation using Eviews 9

Appendix n°3: ADF test results at level and first difference

Level		
Variables	**Intercept**	**Intercept and trend**
EMP	0.20	-1.69
OP	-1.03	-2.43
GDP	-0.44	-1.95
First difference		
EMP	-5.35*	-5.34*
OP	-5.90*	-5.81*
GDP	-4.97*	-4.90*
* are showing stationary at 5%.		

Source: Calculation using Eviews 9

Appendix n°4: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-0.96	NA	0.000259	0.25	0.39	0.30
1	94.34	166.03*	9.94*	-5.31	-4.75*	-5.13*
2	103.63	14.37	9.95	-5.33*	-4.35	-5.01

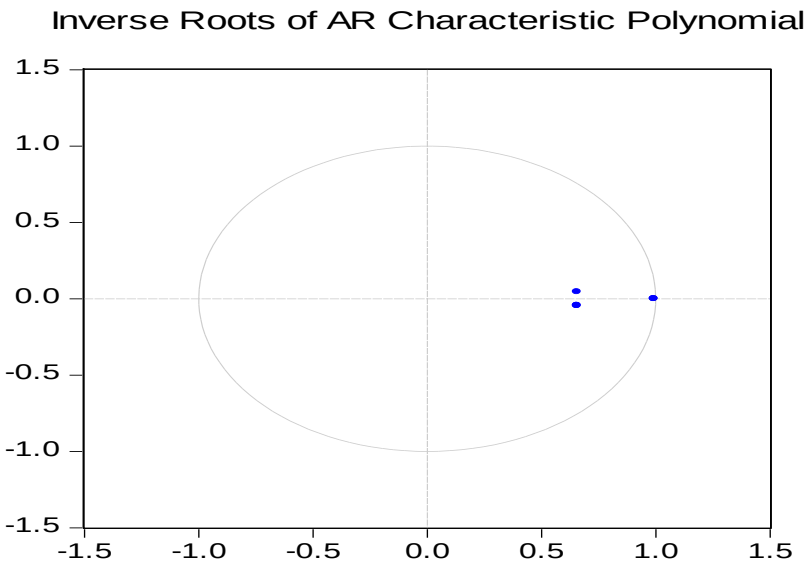
Source: Calculation using Eviews 9

Appendix n°5: Autocorrelation LM test

Lags	LM-Stat	Prob
1	14.14561	0.1172
2	7.995372	0.5346
3	4.843639	0.8477
4	4.810813	0.8505
5	12.79077	0.1723
6	9.362522	0.4045
7	3.524342	0.9398
8	5.539449	0.7850
9	7.457176	0.5896
10	4.811658	0.8504

Source: Calculation using Eviews 9

Appendix n°6: AR roots graph



Source: Calculation using Eviews 9

Appendix n°7: Granger Causality Tests

Sample: 1985 2017
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LOP does not Granger Cause LEMP	32	7.74351	0.0094
LEMP does not Granger Cause LOP		3.52435	0.0706
LGDP does not Granger Cause LEMP	32	9.02478	0.0054
LEMP does not Granger Cause LGDP		0.30079	0.5876
LGDP does not Granger Cause LOP	32	6.20342	0.0187
LOP does not Granger Cause LGDP		1.63647	0.2110

Source: Calculation using Eviews 9