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THE EFFECT OF FOREIGN DIRECT INVESTMENT ON ALGERIAN ECONOMY

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Abstract
Foreign direct investment in Algeria as a percentage of GDP represented 0.9% during the last decade. The goal of this study is to assess the effect of Foreign Direct Investment on Algerian economy through an empirical analysis by applying the bounds testing ARDL and ECM-ARDL using annual data for the period 1970-2014. As far as the role of FDI is concerned, we shall try to highlight its effect that may show causal relationships to non-hydrocarbon GDP, non-hydrocarbon export, industry and employment in long run. Our estimation of an ARDL model indicates that the political and macroeconomic stability are not enough to attract FDI to help non-hydrocarbon sectors drive economic growth.

Keywords: Algerian Economy, FDI, ARDL Model, GDP, Growth

INTRODUCTION

Foreign direct investment (FDI) is a crucial factor to stimulate economic growth for many countries especially in less developed ones that cannot rely solely upon their own resources to promote their economies. It is known that from the early seventies the need for FDI was not so strong for Socialist Algeria which relied on its own resources as well as international credits for its own development that focuses on petrochemicals, steel and plastics as key industries for economic growth. Considering that FDI was viewed as the extension of colonialism, Boumedienne's planning and his socialist management concentrated on public dominance over all sectors of the Algerian economy instead of promoting investment by attracting foreign direct investment. Between 1980 and 1990 the FDI flow increased at an average rate of about 7 percent a year compared with average rates of 0.08 percent as a percentage of GDP.

The persistence of a low level in foreign direct investment flows since the 1990s (black decade*)* has been associated with an average rate of 3 % of annual FDI inflows. However, in 1999, FDI remained remarkably high as a percentage of GDP as it rose to 0.6 percent.

FDI inflows varied between 1 and 2 billion dollars during last decade. From 2001 to 2014, Even though Algerian economy has been characterized by some political and macroeconomic stability, it remains that its attractive potential to FDI was not up to its expectations as foreign investors are still reluctant to take the decision to transfer their assets to Algerian market.

The goal of this study is to assess however, the effect of Foreign Direct Investment on Algerian economy through an empirical analysis by applying the bounds testing ARDL and ECM-ARDL using annual data for the period 1970-2014. The rest of the paper is organized as follows. In section 2 we present a literature review on the relationship. Section 3 presents the model and the methodology, followed by the results and discussion in Section 4, and finally, section 5 presents the main conclusion.

LITERATURE REVIEW

Many studies have highlighted the different impacts of FDI on macroeconomic variables such as GDP growth, exports, unemployment rates, inflation, industrial sector, the stock market, etc. Firstly, Solow 1956 as among the oldest pioneer in the theorization of FDI emphasized the crucial role of technological progress as a specific investment to explain economic growth followed by the Harrod-Domar model of economic growth (See Sato1964), Kaldor 1963, Findlay 1978, Lucas 1988, Romer 1989, Barro 1990, robelo 1991, Frankel and Romer 1999 advanced second generation theories that developed endogenous input to FDI.

Secondly, there are many empirically studies that focus on the positive impact of FDI on macroeconomic variables, Choe (2003) used Granger causality test to detect some impacts of FDI to economic growth in 80 developed and developing countries for the period 1971 – 1995. Using similar technique, Al-Iriani (2007) found bidirectional causality between FDI and economic growth in GCC countries during the period from 1970 to 2004.

Chowdhury and Mavrotas (2006) pointed out in their study the existence of Bidirectional causality in Malaysia and Thailand using Lag-augmented vector auto-regression for the period 1969-2000. Shaikh (2010) found a significant relationship between economic growth and foreign direct investment inflows (FDI) in Malaysia during the period 1970 to 2005.

On the contrary, De Mello (1999) found week impact for FDI effects on economic growth in 32 developed and developing countries in the period 1970- 1990. Manuchehr and Ericsson (2001) confirmed a null impact between Finland and Denmark as far as the impact of FDI in both economies is concerned since the 1970s. Zenasni and Benhabib (2015), using a Granger causality test for the period 1980-2013, found that FDI had a positive but a negligible effect on Algerian economic growth whilst concomitantly domestic investment exhibited significant effects.

Moreover, Belloumi (2014) examined the relationship between foreign direct investment (FDI), trade openness and economic growth by applying the bounds testing (ARDL) Model for the period from 1970 to 2008. His results suggested that there is no significant Granger bidirectional causality between FDI and economic growth particularly in the short run. Dritsaki and Stiakakis (2014) applied for Croatia a ECM-ARDL Model using annual data for the period 1994-2012 and arrived to the conclusion that there is a negative sign of FDI to lead to substantial economic growth in Croatia. Additively, Sarkar (2007) presented a negative relationship between FDI and economic growth in 51 less developed countries from 1970 to 2002.

METHODOLOGY

Data Sources

The sample comprises 45 annual observations for the period 1970 - 2014.The sources of our variables are collected from different issues of International financial Statistics, world development indicators and the Bank of Algeria**.**

The Econometric Approach

The ARDL model is used to analyze cointegration series for short and long-run dynamics, even when the time-series are stationary I(0) or integrated of order I(1). The variables may

include a mixture of stationary and non-stationary time-series for ARDL Bounds testing approach proposed by Pesaran (1997), Pesaran, Smith and Shin (2001) and Pesaran et al. (2001). In addition, the bounds testing procedure (Pesaran et al., 2001) proposed in this study is robust for small sample (Abd Pattichis, 1999; Mah, 2000; and Tang and Nair, 2002, Halim et al 2008).

Our variables are FDI, $FDI_{t-1,}$ NHGDP, NHEXP, EMPL and INDVA that represent respectively non-hydrocarbon GDP, non-hydrocarbon export, industry and employment.

The mathematical representation of an ARDL regression model is:

$inv_t = \beta_0 + \beta_1 inv_{t-1} + ...+ \beta_k inv_{t-p} + \alpha NHGDP_{0t} + \alpha_1 NHEXP_{t-1} + \alpha_2 indva_{t-2} + \alpha_3 empl_{t-3} + + \varepsilon$**……..(1)**

Where:

ε_t is a random "disturbance" term.

β_0= Intercept of the function

$\beta_{1,}\ \alpha_{0,}\ \alpha_{1,}\ \alpha_{2,}\ \alpha_3$ are parameter estimates.

Before presenting empirical results of the ARDL model, we apply the following econometric steps needed for stationary Test of the data. Firstly, we use the Augmented Dickey-Fuller & Philips-Perron test then we proceed to determine the F-test for ARDL Model.

EMPIRICAL RESULTS AND DISCUSSION

Stationary Test Results

Before estimating the ARDL bounds approach, we use the Augmented Dickey-Fuller (1979, 1981) and Phillips and Perron (1988) tests for stationary and non-stationary time-series. The results are represented in Table 1 showing that all variables are integrated of order one (I (1)) except the non-hydrocarbon GDP and industry variables, though they are stationary at levels (I (0)).

Table 1: Stationary Test Results

Variable	ADF		PP	
	Level	First difference	Level	First difference
Inv	-1.89	-10.21***	-1.89	-9.92***
NHGDP	-2.95**	-4.71***	-2.95**	-4.94***
NHEXP	-1.91	-5.76***	-1.92	-5.76***
Indva	-3.58**	-8.67***	-3.61***	-14.93***
unmpl	-0.90	-5.42***	-1.22	-5.44***

*show values are significant at 10 % level with MacKinnon (1996).
**show values are significant at 1% level with MacKinnon (1996).
***show values are significant at 5 % and 1 level with MacKinnon (1996).

Cointegration Test

Secondly in order to detect the best optimal lags length, we use several tests such as : the Akaike information criterion (AIC) test (1974, 1976), the Hannan-Quinn criterion (HQC), (1979) and the Schwarz Criterion (SC) (1978). The ARDL model used in long and short run are expressed as follows according to the choice of the equations that present more advantages with less value in former tests.

Long-Run

$$\Delta FDI = \beta_{01} + \alpha_{11} GDPNH_{t-1} + \alpha_{21} EXPNH_{t-1} + \alpha_{31} INDva_{t-1} + \alpha_{41} EMP_{t-1} + \alpha_{51} FDI_{t-1} + \mu_{1t} \quad \textbf{(2)}$$

$$\Delta GDPNH = \beta_{02} + \alpha_{12} FDI_{t-1} + \alpha_{22} EXPNH_{t-1} + \alpha_{32} INDva_{t-1} + \alpha_{42} EMP_{t-1} + \alpha_{52} GDPNH_{t-1} + \mu_{2t} \quad \textbf{(3)}$$

$$\Delta EXPNH = \beta_{03} + \alpha_{13} GDPNH_{t-1} + \alpha_{23} FDI_{t-1} + \alpha_{33} INDva_{t-1} + \alpha_{43} EMP_{t-1} + \alpha_{53} EXPNH_{t-1} + \mu_{3t} \quad \textbf{(4)}$$

$$\Delta INDva = \beta_{04} + \alpha_{14} GDPNH_{t-1} + \alpha_{24} FDI_{t-1} + \alpha_{34} EXPNH_{t-1} + \alpha_{44} EMP_{t-1} + \alpha_{54} INDva_{t-1} + \mu_{4t} \quad \textbf{(5)}$$

$$\Delta EMP = \beta_{05} + \alpha_{15} GDPNH_{t-1} + \alpha_{25} FDI_{t-1} + \alpha_{35} INDva_{t-1} + \alpha_{45} EXPNH_{t-1} + \alpha_{55} EMP_{t-1} + \mu_{5t} \quad \textbf{(6)}$$

In order to determine the long-run effect of FDI on Algerian macroeconomic variables, we compute the F-statistic compared with the critical value tabulated by Pesaran et al. (2001) at the 5 percent level. On the basis of Wald Test results in different equation :(2), (3), (4), (5), (6) , we accept the null hypothesis (H_0) and reject (H_1) as the alternative hypothesis, (no existence of cointegration) in long run among the variables.

$$H_0: \delta_{11} = \delta_{21} = \delta_{31} = \delta_{41} = \delta_{51}$$
$$H_1: \delta_{11} \neq \delta_{21} \neq \delta_{31} \neq \delta_{41} \neq \delta_{51}$$

and

$$H_0: \delta_{12} = \delta_{22} = \delta_{32} = \delta_{42} = \delta_{52}$$
$$H_1: \delta_{12} \neq \delta_{22} \neq \delta_{32} \neq \delta_{42} \neq \delta_{52}$$

and

$$H_0: \delta_{13} = \delta_{23} = \delta_{33} = \delta_{43} = \delta_{53}$$
$$H_1: \delta_{13} \neq \delta_{23} \neq \delta_{33} \neq \delta_{43} \neq \delta_{53}$$

and

$$H_0: \delta_{14} = \delta_{24} = \delta_{34} = \delta_{44} = \delta_{54}$$
$$H_1: \delta_{14} \neq \delta_{24} \neq \delta_{34} \neq \delta_{44} \neq \delta_{54}$$

and

$$H_0: \delta_{15} = \delta_{25} = \delta_{35} = \delta_{45} = \delta_{55}$$
$$H_1: \delta_{15} \neq \delta_{25} \neq \delta_{35} \neq \delta_{45} \neq \delta_{55}$$

On the basis of the results in Table 2, we may conclude that there is no effect of foreign direct investment on the Algerian macroeconomics variables in the long-run.

Table 2: Long Run Results

Dependent variable: GDPHH (Equation 3)		**Dependent variable: NHEXP (Equation 4)**		**Dependent variable: INDVA (Equation 5)**		**Dependent variable: Unmp (Equation 6)**	
Variables	coefficients	variables	coefficients	variables	coefficients	variables	coefficients
FDI $_{t-1}$	0,098	FDI $_{t-1}$	0,442	FDI $_{t-1}$	-0,106	FDI $_{t-1}$	-0,396
GDPHH $_{t-1}$	-0,009	NHEXP $_{t-1}$	0,032	INDVA t-1	0,005	Unmp $_{t-1}$	-0,324
NHEXP $_{t-1}$	0,060	GDPHH $_{t-1}$	-1,165	GDPHH $_{t-1}$	0,004	GDPHH $_{t-1}$	0,019
INDVA $_{t-1}$	-0,434	INDVA $_{t-1}$	2,003	NHEXP $_{t-1}$	0,040	NHEXP $_{t-1}$	-0,413
Unmp $_{t-1}$	0,071	Unmp $_{t-1}$	0,047	Unmp $_{t-1}$	0,064	INDVA $_{t-1}$	0,350
R^2	0,710	R^2	0,750	R^2	0,800	R^2	0,680
F-Statistic	2,180	F-Statistic	3,350	F-Statistic	4,050	F-Statistic	2,190
D-W	2,000	D-W	2,360	D-W	2,350	D-W	2,270
serial correlation	NO	serial correlation	NO	serial correlation	NO	serial correlation	NO

*show values are significant at 5 %

In the Short Run

The mathematical representation of the cointegration analysis in the short run is:

$$\Delta FDI = \beta_{01} + \delta_{11} GDPNH_{t-1} + \delta_{21} EXPNH_{t-1} + \delta_{31} INDva_{t-1} + \delta_{41} EMP_{t-1} + \delta_{51} FDI_{t-1} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta GDPNH_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\, \Delta EXPNH_{t-1} + \sum_{i=0}^{p} \alpha_{3i}\, \Delta INDva_{t-1} + \sum_{i=0}^{p} \alpha_{4i}\, \Delta EMP_{t-1} + \sum_{i=0}^{p} \alpha_{5i}\, \Delta FDI_{t-1} + \varepsilon_{1t} \quad \textbf{(7)}$$

$$\Delta GDPNH = \beta_{02} + \delta_{12} FDI_{t-1} + \delta_{22} EXPNH_{t-1} + \delta_{32} INDva_{t-1} + \delta_{42} EMP_{t-1} + \delta_{51} GDPNH_{t-1} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta FDI_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\, \Delta EXPNH_{t-1} + \sum_{i=0}^{p} \alpha_{3i}\, \Delta INDva_{t-1} + \sum_{i=0}^{p} \alpha_{4i}\, \Delta EMP_{t-1} + \sum_{i=0}^{p} \alpha_{5i}\, \Delta GDPNH_{t-1} + \varepsilon_{1t} \quad \textbf{(8)}$$

$$\Delta EXPNH = \beta_{03} + \delta_{13} FDI_{t-1} + \delta_{23} GDPNH_{t-1} + \delta_{33} INDva_{t-1} + \delta_{43} EMP_{t-1} + \delta_{53} EXPNH_{t-1} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta FDI_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\, \Delta GDPNH_{t-1} + \sum_{i=0}^{p} \alpha_{3i}\, \Delta INDva_{t-1} + \sum_{i=0}^{p} \alpha_{4i}\, \Delta EMP_{t-1} + \sum_{i=0}^{p} \alpha_{5i}\, \Delta EXPNH_{t-1} + \varepsilon_{1t} \quad \textbf{(9)}$$

$$\Delta\, INDva = \beta_{04} + \delta_{14} FDI_{t-1} + \delta_{24} GDPNH_{t-1} + \delta_{34} EXPNH_{t-1} + \delta_{44} EMP_{t-1} + \delta_{54} INDva_{t-1} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta FDI_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\, \Delta GDPNH_{t-1} + \sum_{i=0}^{p} \alpha_{3i}\, \Delta EXPNH_{t-1} + \sum_{i=0}^{p} \alpha_{4i}\, \Delta EMP_{t-1} + \sum_{i=0}^{p} \alpha_{5i}\, \Delta INDva_{t-1} + \varepsilon_{1t} \quad \textbf{(10)}$$

$$\Delta\, EMP = \beta_{05} + \delta_{15} FDI_{t-1} + \delta_{25} GDPNH_{t-1} + \delta_{35} EXPNH_{t-1} + \delta_{45} INDva_{t-1} + \delta_{55} EMP_{t-1} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta FDI_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\, \Delta GDPNH_{t-1} + \sum_{i=0}^{p} \alpha_{3i}\, \Delta EXPNH_{t-1} + \sum_{i=0}^{p} \alpha_{4i}\, \Delta INDva_{t-1} + \sum_{i=0}^{p} \alpha_{5i}\, \Delta EMP_{t-1} + \varepsilon_{1t} \quad \textbf{(11)}$$

In the short run, all dependent macroeconomic variables exhibit a four cointegration relationship with foreign direct investment. We note furthermore, in Table 3, through econometric diagnostic tests, the absence of serial correlation while Durbin Watson seems to be good with high R^2 - more than 60 percent in all models- except for the last one. It is clear to show in the first model that a change in the non hydrocarbon GDP by one percent leads to an increase of non hydrocarbon exports by 0.17%, while a change in FDI shows a negative sign which implies that there is statistically an insignificant effect and a decrease in the non hydrocarbon GDP by 0.09%.

The empirical results of FDI on non hydrocarbon exports identified in equation 9 in Table 3 show through some coefficients that one percent change in non hydrocarbon GDP and industry sector leads to 0.72% rise and 1.76 drop respectively on non hydrocarbon exports . The foreign direct investment appears to have had a negligible effect on the Algerian non hydrocarbon export. Finally, we find another negligible effect of NHGDP, NHEXP and FDI on industry value added whose coefficient does not exceed 0.05.

Table 3: Short Run Results

Dependent variable: NHGDP (Equation 8)		**Dependent variable: NHEXP (Equation 9)**		**Dependent variable: INDVA (Equation 10)**		**Dependent variable: Unmp (Equation 11)**	
variables	coefficients	variables	coefficients	variables	coefficients	variables	Coefficients
d(inv(-1))	-0,009	d(inv(-1))*	-0,020	d(NHEXP(-1))*	-0,069	d(inv(-1))	-0,002
d(NHEXP(-1))*	0,178	d(gdphh(-1))*	0,722	d(gdphh(-1))	0,046	d(indva(-1))	0,155
d(indva(-1))	0,277	d(indva(-1))*	-1,699	d(inv(-1))*	-0,011	d(NHEXP(-1))	-0,051
d(unmp(-1))	-0,137	d(unmp(-1))	-0,247	d(unmp(-1))	0,030	d (gdphh(-1))	-0,116
ECT (-1)	0,124	ECT (-1)*	-0,238	ECT (-1)	-0,031	ECT (-1)*	0,991
R^2	0,710	R^2	0,620	R^2	0,600	R^2	0,680
F-Statistic*	2,180	F-Statistic*	2,560	F-Statistic	1,720	F-Statistic*	4,350
D-W	2,000	D-W	1,960	D-W	1,790	D-W	1,300
serial correlation	NO	serial correlation	NO	serial correlation	NO	serial correlation	Yes

* show values are significant at 5 %

ECM $_{t-1}$ Results

We use the Error correction coefficient (ECM) as signal to explain that the deviation in the long-run relationship will be fed into its short-run dynamics, See Granger J. (1987). Thus, it may be better that ECM t-1 should be negative and significant.

Table 3 reports the results for ECM $_{t-1.}$ Speed of adjustment for models 2 and 3 that allow correcting long run equilibrium at 26 and 3% respectively, with negative and significant coefficient. Thus, Model 1 shows a positive and statistically insignificant error correction coefficient. This cannot be interpreted as a good sign for the converging relationship in the long run between non-hydrocarbon GDP and foreign direct investment in Algeria. Moreover, the ECM $_{t-1}$ of unemployment as dependant variable presents the problem of autocorrelation. Also, this result confirms the absence of any structural change of FDI to converge towards equilibrium in the long run.

CUSUM and CUSUMSQ Test

Having found a significant and negative of ECM t-1 coefficient in equation 9 and 10: (Figures 1 and 2), the CUSUM (cumulative sum) and CUSUMSQ (CUSUM squared) tests are then introduced to check for the stability of the relationship in the short run dynamics within a long run equilibrium, Brown et al. (1975).

Figure 1: CUSUM and CUSUMSQ Test of FDI Impact on Non-Hydrocarbon Exports

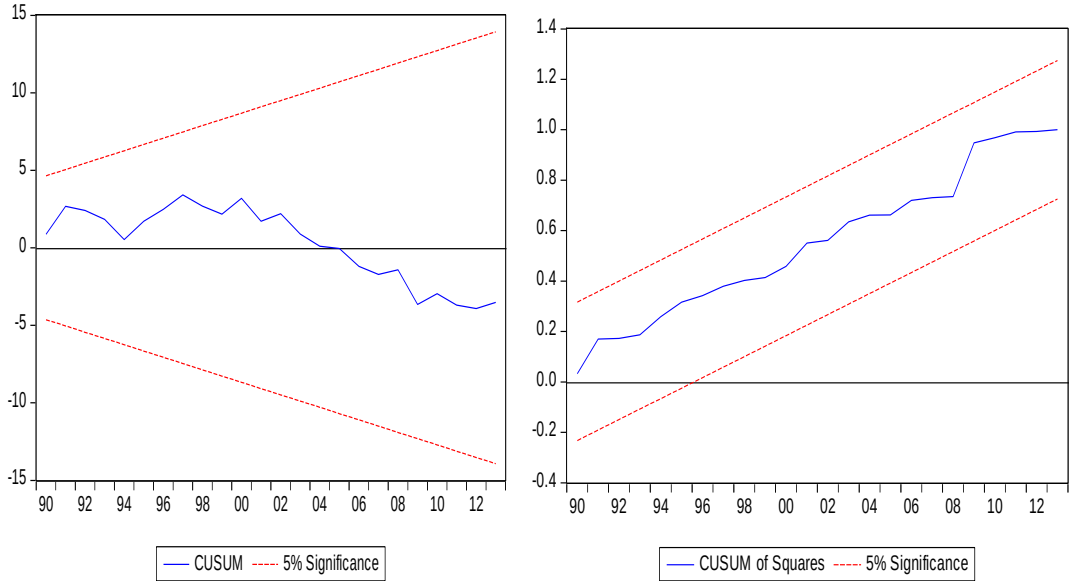
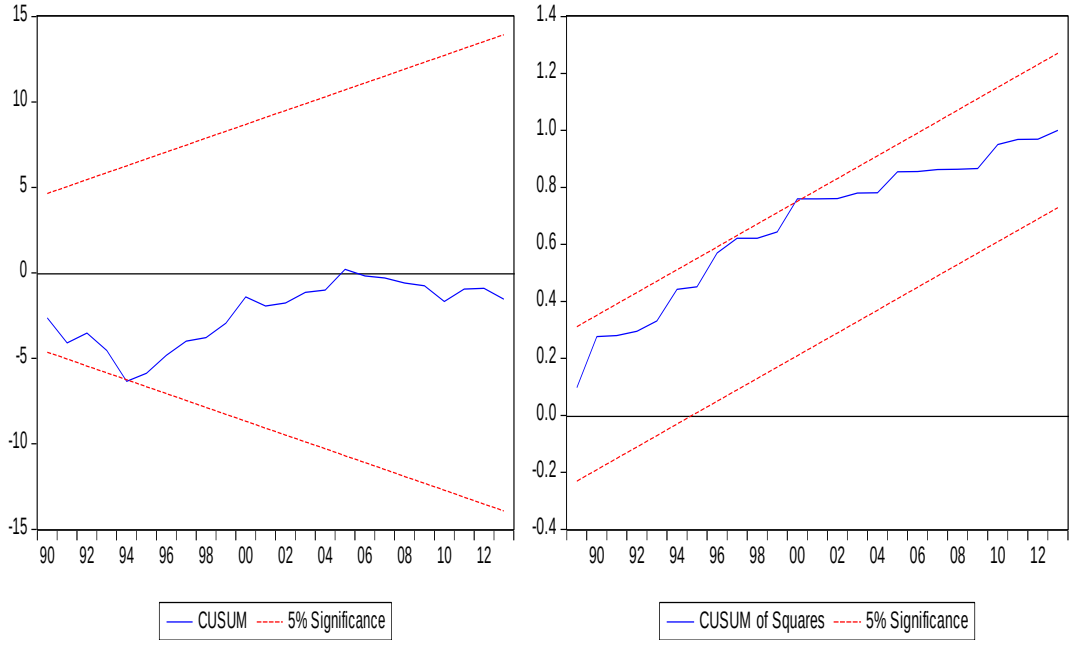


Figure 2: CUSUM and CUSUMSQ Test of FDI Impact on Industry



CONCLUSION

In this paper, we investigated if Foreign Direct Investment has an effect on Algerian macroeconomic variables (non-hydrocarbon GDP, non-hydrocarbon export, industry and employment). The estimation through the bounds testing ARDL and ECM-ARDL allows detecting that FDI is ineffective and presents a negligible impact on non-hydrocarbon export as

well as industry in the short run. In the long run, our estimation using cointegration analysis does not highlight a dynamic relationship between first, FDI and non hydrocarbon economic growth, second, FDI and unemployment and third, FDI and non hydrocarbon Exports.

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