The Impact of FDI on Poverty Reduction in North Africa

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Abstract

The aim of this paper is to study the impact of FDI on poverty in the case of the North African country during the period from 1985 to 2005. The sample used in this paper consists of 6 countries of North Africa during the period from 1985 to 2005. So we can use the cointegration test. For the cointegration test, we have certified the existence of a cointegration relationship between the different series studied in our paper. Indeed, the result of the null hypothesis test of no cointegration was rejected at the 5% threshold, which explains the presence of a cointegration relationship. Also, to test the effect of FDI on poverty in the countries of North Africa, we will perform a FMOLS estimate. Thus, for the short-term dynamics, we noticed that FDI have a positive and significant impact on a threshold of 1% on the GINI index for the case of the countries of North Africa and a significant negative a threshold of 1% for the other two indicators of poverty; LPOV1_91 $ and LPOV3_1 $. Then we found that is statistically significant and positive at a 1% level. The LIDE variable measuring foreign direct investment has a negative impact on the Gini index to a threshold of 5%.For the Granger causality test; we notice that there is a unidirectional relationship between the consumption of energy and poverty Granger. Only the GINI index can cause Granger consumption of energy.

Keywords: IDF, poverty, North Africa, cointegration, FMOLS

1. Introduction

The indirect impact of FDI on poverty reduction through economic growth and FDI relationship was widely covered in the literature. The majority of these studies assume that what is good for growth is good for the poor (Sumner, 2005). The lack of a simple positive impact of FDI on poverty reduction motivated investigations on the possible direct impact of FDI on poverty reduction. The literature on the direct impact of FDI on poverty reduction is still insufficient.

Although the Millennium Development Goal (MDG) of reducing extreme poverty and hunger by 2015 has been met at the global level, some countries still experiencing high levels of poverty. While the struggle for the eradication of poverty continues, the MDGs was signed in 2015 within the United Nations sustainable development goals, strengthening the pressure on developed and developing governments to seek solutions to reducing poverty in national and international relations.

The conflicting findings about the relationship between FDI and poverty reduction policymakers have left a number of questions about the benefits that can be derived from liberal policies that encourage FDI flows.

Existing studies, which are based on different countries, poverty indicators and various econometric approaches, have failed to provide a conclusive answer to the link between FDI and poverty.

The impact of FDI on poverty reduction has been the subject of much controversy and so far, investigations are continuing in order to disentangle the possible benefits of FDI for poverty reduction.

The literature on the impact of FDI on poverty is divided between the search for a positive impact of FDI on poverty reduction, and a negative impact, or an insignificant impact of FDI on reducing poverty.

Some of the positive contributions of FDI on poverty reduction are achieved through spillover effects in job creation and increased investment capital (Meyer, 2004; Gorg and Greenaway, 2004). The literature that supports a negative or insignificant impact of FDI on poverty reduction is covered by the dependency theory, which explains the underdevelopment of developing countries and how the nature of development leads to poverty.

The spillover effects can be divided into two categories, namely horizontal and vertical. The horizontal spillovers arising from non-contractual and non-market operations, where external parties, in this case the domestic companies, benefit from resources from foreign companies (Meyer, 2004).

These benefits are also called externalities (Meyer, 2004). According to Meyer (2004), spillover effects in this category occur mainly in intra-industry configuration.

Thus, this paper has been devoted to relevant empirical study to clarify the impact of FDI on poverty in the case of the North African country during the period from 1985 to 2005. The sample used in our paper consists of 6 countries of North Africa during the period from 1985 to 2005. We concluded that on the basis of the test statistics of Im-Pesaran-Shin (IPS) test, ADF-Fisher test and PP-Fisher test, we can conclude that only three variables LIDE, LPIB, LINF and are stationary in LUE level. But first difference, all variables are stationary according to these three tests. Thereafter, all the variables are integrated of order 1. Thus, we can use the cointegration test. For the co-integration test, we have certified the existence of a cointegration relationship between the different series studied in our paper. Indeed, the results of the null hypothesis test of no cointegration were rejected at the 5% threshold, which explains the presence of a cointegration relationship.

The results of these tests can determine the use of an error correction model. Also, to test the effect of FDI on poverty in the countries of North Africa, we will perform a FMOLS estimate. Thus, for the short-term dynamics, we noticed that FDI have a positive and significant impact on a threshold of 1% on the GINI index for the case of the countries of North Africa and a significant negative a threshold of 1% for the other two indicators of poverty; LPOV1_91 LPOV3_1 $ and $. Then we found that is statistically significant and positive at a 1% level. Noula LIDE variable measuring foreign direct investment has a negative impact on the Gini index to a threshold of 5%. That is to say, if the level of FDI increased by 5 units, then the GINI index decreases by 0.007476 units. For the Granger causality test, we noticed that there is a unidirectional relationship between the consumption of energy and poverty Granger. Only the GINI index can cause Granger consumption of energy.

The rest of the paper is organized as follows: In Section 2, we present a literature review. The third section summarizes the econometric methodology. Data are presented in Section 4. Section 5 was dedicated to the interpretation of results. The conclusion is made in section 6.

2. Literature review

Hung (1999) analyzes the relationship between FDI and poverty between 1992 and 2002 in a sample of 12 cities in Vietnam. He uses the incidence of poverty as a measure of poverty. Hung (1999) finds that a 1% increase in FDI has reduced the number of people living in poverty by 0.05%. This direct impact of FDI on poverty reduction was rated higher than the indirect effects of GDP growth.

Similarly, Jalilian and Weiss (2002) study the relationship FDI-growth-poverty the CountryASEAN (ASEAN). They took a sample of 26 countries including 18 ASEAN countries are developing and 8 developed countries, the authors use the method of unbalanced panel data (unbalanced panel data) over a period from 1997 to 2007. Their econometric analysis shows that FDI inflows, particularly in the case of ASEAN, are associated with higher economic growth and there is a close relationship between the growth in average income and growth of income of the poor. In their sample for ASEAN, on average, about 40% of the effects of FDI on poverty reduction from economic growth and the remaining 60% are directly related, so the results show a positive association between FDI and reduction poverty

In the same way, Calvo and Hernandez (2006) examine the effects of FDI on poverty in 20 American Country between 1984 and 1998. Based on panel data, the authors used two dependent variables: the actual and the poverty gap. They found that the benefits of FDI vary the initial local conditions and orientation of the foreign subsidiary. They found that FDI reduce poverty on a global level. If foreign capital has doubled, the number of poor declined.

As for Nunnenkamp et al. (2007) use the CGE analysis to examine the effects ofFDI Poverty in Bolivia. The authors used a model of a modified version of general equilibrium which had 11 production sectors, 7 factors, and 6 types of households. The simulation results showed that FDI improves economic growth and reduced poverty. Other results showed that FDI generally widen income disparities between urban and rural areas and, in particular, led to increased employment and remuneration of the factors in urban areas.

Moreover, Reiter and Steensma (2010) conduct a study on the relationship between human development captured by the human development index (HDI), and FDI in a sample of 49 developing countries between 1980 and 2005. The sample consists of a panel data set of 49 developing countries over the period 1980-2005, the authors use the method of unbalanced panel data. The results were consistent with the results of Jalilian and Weiss (2002). The

relationship between FDI and improving human development is also more strongly positive when corruption is low. So the results show a positive association between FDI and poverty reduction.

Moreover, Zaman et al. (2012) have attempted to assess the impact of FDI on poverty reduction in Pakistan. They took time series data over a period of 26 years (1985-2011) based on a multi varied regression framework. . OLS estimates of the results showed a coefficient of FDI, implying that the increase in FDI will result in poverty reduction .They have concluded a positive link between FDI and poverty reduction in Pakistan.

Mahmood and Chaudhary (2012) also study the contribution of FDI to the reduction of poverty, lhe authors use the model of ARDL in Pakistan between 1973 and 2003.L'étude is the long-term relationship, short-term in the model. Government spending on health and education as well as the rate of economic growth have significant negative effects on poverty. The IDE helps therefore to reduce the level of poverty in Pakistan.

Meanwhile, Shamim et al. (2014) empirically analyze the relationship between FDI and poverty reduction in Pakistan. The period covered by this study was 1973-2011, the model used is the technique of time series data cointegration (time series data cointegration tehnique). The results showed that there was a positive relationship between FDI and reduction poverty, as Fowowe and Shuaibu (2014) and Jalilian and Weiss (2002).

Ucal (2014) also assess the relationship between foreign direct investment (FDI) and poverty to the macro-way in some developing countries. In this study, the author considers the unbalanced panel data method 26 countries in UNCTAD over a period of 24 years between 1990 and 2009. The results show that there is a statistically significant relationship between FDI and poverty. It is obvious that FDI reduces poverty in some developing countries.

Besides, Bharadwaj (2014) studies the relationship between globalization and poverty, the impact of real and financial integration on the counting rate and the poverty gap. In the study, FDI was used as indicator of globalization, while the population ratio and the poverty gap are indicated poverty Using a regression in 35 countries in the process of panel data development from 1990 to 2004, Baradwaj (2014) shows that the growth and the opening of GDP per capita are beneficial for the poor and FDI was considered beneficial for reducing poverty in countries in the sample.

In parallel, Uttama (2015) studies the relationship between FDI and the reduction of poverty. The data set includes transnational observations for six member countries of ASEAN (Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam) during the period 1995-2011 using the technique of spatial panel data model, The analyzes confirm the significant positive relationship between FDI and poverty reduction in ASEAN, both individually and space.

3. Empirical Methodology

In our paper, we will use the model developed by Im and McLaren (2015) to study the impact of FDI on poverty in the countries of North Africa. The model used was as follows:

$$POV = f\left(IDE, V\right)$$

Where POV poverty measure for each country, FDI measure foreign direct investment and V represents a vector of control variables. Thus, the control variables, the growth rate of gross domestic product (GDP), youth literacy rate (TAJ), financial development measured by domestic credit to the private sector (DF), the urban population (PU), government spending (DEP) Market capitalization of listed companies (CBEC), the consumption or use of energy (EU), the inflation rate (INF), energy use renouvlable (CER), the gross capital formation (BCF) and the unemployment rate (CH).

Note that poverty is measured by three indicators:

- The GINI index.
- The poverty gap at $ 1.91.
- The poverty gap of $ 3.1.

FDI is measured by the level of FDI to GDP for each country.

The models to estimate are:

$$
\begin{aligned}
LGINI_{it} = {} & \beta_0 + \beta_1 LIDE_{it} + \beta_2 LCO2_{it} + \beta_3 LINF_{it} + \beta_4 LPIB_{it} + \beta_5 LPU_{it} \\
& + \beta_6 LTAJ_{it} + \beta_7 LUE_{it} + \beta_8 LDEP_{it} + \beta_9 LDEF_{it} + \beta_{10} LFBC_{it} \\
& + \beta_{11} LCH_{it} + \beta_{12} LCER_{it} + \beta_{13} LCBEC_{it} + \varepsilon_{it}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
LPOV1.91\$_{it} = {} & \beta_0 + \beta_1 LIDE_{it} + \beta_2 LCO2_{it} + \beta_3 LINF_{it} + \beta_4 LPIB_{it} + \beta_5 LPU_{it} \\
& + \beta_6 LTAJ_{it} + \beta_7 LUE_{it} + \beta_8 LDEP_{it} + \beta_9 LDEF_{it} + \beta_{10} LFBC_{it} \\
& + \beta_{11} LCH_{it} + \beta_{12} LCER_{it} + \beta_{13} LCBEC_{it} + \varepsilon_{it}
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
LPOV3.1\$_{it} = {} & \beta_0 + \beta_1 LIDE_{it} + \beta_2 LCO2_{it} + \beta_3 LINF_{it} + \beta_4 LPIB_{it} + \beta_5 LPU_{it} \\
& + \beta_6 LTAJ_{it} + \beta_7 LUE_{it} + \beta_8 LDEP_{it} + \beta_9 LDEF_{it} + \beta_{10} LFBC_{it} \\
& + \beta_{11} LCH_{it} + \beta_{12} LCER_{it} + \beta_{13} LCBEC_{it} + \varepsilon_{it}
\end{aligned}
\tag{3}
$$

Or, β_0 is a constant, β_i are coefficients of the explanatory variables i = 1, ..., 13 and ε_{it} it is the term of error. Table 1 summarizes the different variables used in our paper.

Table 1. The variables

Nature of factor	The variable	Code Variable	Source
Dependent variable	GINI Index	GINI	world Bank
Dependent variable	Poverty to $ 1.90 a day (2011 PPP) (%)	$ POV1.91	world Bank
Dependent variable	Poverty to $ 3.10 a day (2011 PPP) (%)	$ POV3.1	world Bank
Control variable	CO2 emissions (kt)	CO2	world Bank
Control variable	Foreign direct investment, net inflows (% of GDP)	FDI	world Bank
Control variable	Youth literacy rate (% of youth aged 15 to 24)	TAJ	world Bank
Control variable	GDP per capita (annual%)	GDP	world Bank
Control variable	Public expenditure (% of GDP)	DEP	world Bank
Control variable	Use of renewable energy (% of total energy consumed)	CER	world Bank
Control variable	Inflation, consumer prices (annual%)	INF	world Bank
Control variable	urban population (% of total)	PU	world Bank
Control variable	Market capitalization of listed companies (% of GDP)	CBEC	world Bank
Control variable	Unemployment, total (% of population) (ILO modeled estimate)	CH	world Bank
Control variable	Gross capital formation (% of GDP)	FBC	world Bank
Control variable	Domestic credit to private sector (% of GDP)	DF	world Bank
Control variable	Energy use (kg oil equivalent) per $ 1,000 GDP (PPP constant 2011)	EU	world Bank

The data used in this paper are of annual frequency for all variables. These data come from the World Bank database and the International Monetary Fund for the period from 1985 to 2015.We will estimate the models chosen by referring to an analysis of panel data.

The choice of panel data is based on the two dimensions of the data used; the first dimension is time (a period of 31 years) and the second is individual (employee sample consists of 6 countries of North Africa).

4. Data

In this section, we present the sample and the model used in our paper. Our objective in this paper, Is the study of the impact of FDI on poverty in the case of the North African country during the study period between 1985 and 2015.

In Table 2, we exposed the different countries in our paper.

Table 2. The countries of North Africa

Name of country	Area (km)	Population (2016 estimate)	Population density (per km²)
Algeria	2381741	37,100,000	14.5
Egypt	1001450	81,249,302	80.4
Libya	1759540	6461450	3.7
Morocco	710 850	32,245,000	70.8
Sudan	1886068	31957965	16.9
Tunisia	163610	10673000	64.7

In this section we will try to make a descriptive analysis of the different results for the study the impact of FDI on poverty in the countries of North Africa.

First, let's define the type of assessment which is a regression on panel data. Our choice is justified by the presence of two dimensions in the data used; is the first time (a period of 31 years) and the second is individual (our sample is made up of 6 countries of North Africa).

This section is dedicated to the interpretation of results for the descriptive statistics and Pearson correlation matrix for the variables used in our paper.

All of the descriptive statistics of the variables used in our paper are summarized in Table 3.

Table 3. Descriptive statistics

	LGINI	$ LPOV1_91	$ LPOV3_1	LCO2	LIDE	LINF	LPIB	LPU
Average	3.659430	1.711339	2.819903	10.52246	1.740903	12.13125	1.966823	3.953845
Median	3.572328	1.751173	2.913658	10.57184	1.226897	5.737290	1.894978	4.005441
Maximum	4.146937	3.801985	4.074482	12.30497	9.424248	132.8238	104.6576	4.361301
Minimum	3.425890	-0.916291	0.741937	7.975197	-0.469340	-9.797647	-62.21435	3.132751
Standard Deviation	0.192268	1.537783	1.007091	1.022934	1.875266	21.34465	9.915128	0.299145
skewness	1.017615	-0.314673	-0.407684	-0.437984	1.658814	3.792586	4.340137	-0.572764
kurtosis	3.330697	1.869836	1.860567	2.615518	6.371119	18.51450	72.66292	2.511294
Jarque-Bera	32.94928 *	12.96843 *	15.21429 *	7.092390 *	173.3760 *	2311.317 *	38194.09 *	12.02076 *
Probability	0.000000	0.001527	0.000497	0.028834	0.000000	0.000000	0.000000	0.002453
Sum	680.6540	318.3091	524.5020	1957.178	323.8080	2256.413	365.8290	735.4151
Sum Sq. Dev.	6.838913	437.4836	187.6328	193.5830	650.5753	84284.89	18187.31	16.55519
observations	186	186	186	186	186	186	186	186
	LTAJ	LUE	LDEP	LDF	LFBC	CHL	LCER	LCBEC
Average	4.397266	4.647219	2.760326	3.117432	24.17608	2.671726	1.880000	3.329833
Median	4.400727	4.538225	3.187676	3.306042	24.53558	2.694627	2.356580	3.180049
Maximum	4.604464	5.460651	3.566570	4.336893	46.87646	3.394508	4.450014	5.622575
Minimum	4.067913	4.276705	1.401579	0.479664	4.329239	2.091864	-1.730354	0.716136
Standard Deviation	0.148325	0.288363	0.742070	0.959663	7.523842	0.292898	1.737291	1.399367
skewness	-0.428835	1.298344	-0.776126	-0.727663	0.207327	0.045106	-0.529717	-0.324575
kurtosis	2.526260	3.880495	1.924430	2.732941	3.446433	2.417982	2.494614	2.045393
Jarque-Bera	7.440210 **	58.26498 *	27.63912 *	16.96701 *	200.877117	232.688345	10.67806 *	10.32820 *
Probability	0.024231	0.000000	0.000001	0.000207	0.000000	0.000000	0.004801	0.005718
Sum	817.8915	864.3827	513.4206	579.8423	4496.752	496.9410	349.6800	619.3490
Sum Sq. Dev.	4.070076	15.38337	101.8735	170.3764	10472.52	15.87098	558.3630	362.2723
observations	186	186	186	186	186	186	186	186

According to the results of Table 3, we found that the LCO2 variable, which expresses logarithm of CO_2 emissions, can reach a maximum value of 12.30497. As its minimum value is 7.975197. Its risk is measured by the standard deviation is 1.022934.

The LGINI variable, which measures the logarithm of the GINI index, can reach a maximum value of 4.146937. While its minimum value is 3.425890. Its risk is measured by the standard deviation is 0.192268.

The variable $ LPOV1_91, which measures the logarithm of the gap of poverty threshold of $ 1.91 may reach a maximum value of 3.801985. As its minimum value is -0.916291. Its risk is measured by the standard deviation is 1.537783.

The variable $ LPOV3_1, which measures the logarithm of the poverty gap at $ 3.1 threshold, can reach a maximum value of 4.074482. As its minimum value is 0.741937. Its risk is measured by the standard deviation is 1.007091.

Both statistics of asymmetry (skewness) and kurtosis (kurtosis), we can conclude that all variables used in this paper are characterized by non-normal distribution. Then the asymmetry coefficients indicate that all variables are shifted to the left (negative sign of asymmetry coefficients) and is far from symmetrical except for LGINI variables, LIDE, LINF, LPIB, READ, LFBC, LCH, LCER LCBEC and which are oriented to the right (positive sign of asymmetry coefficients).

Also, the kurtosis coefficient shows that leptokurtic for all variables used in this paper indicate the presence of a high peak or a large tail in their volatilities (leptokurtic the coefficients are greater than 1).

In addition, the positive sign of estimation coefficients of Jarque-Bera statistics indicates that we can reject the null hypothesis of the normal distribution of the variables used in our paper. In fact, the high value of the coefficients of the Jarque-Bera statistic reflects the series are not normally distributed at a level of 1 percent.

The results shown by the three skew statistics, kurtosis and Jarque-Bera suggest that all variables used in our paper are not normally distributed for the case of the countries of North Africa and during the study period from 1985 to 2015.

Thus, we conducted a test of the correlation between the different variables used in the case of the North African country during the study period from 1985 to 2015. Table 4 summarizes the results for test Pearson correlation.

In addition, the results showed that all coefficients between the explanatory variables do not exceed the tolerance limit (0.7), which does not cause problems in the estimation of the model. That is to say, we can integrate the different variables used in the same model.

Table 4. The correlation matrix

	LGINI	$ LPOV1_91	$ LPOV3_1	LCO2	LIDE	LINF	LPIB	LPU
LGINI	1.000000	0.216744	0.154968	-0.165647	-0.220977	-0.227902	-0.017152	0.653434
$ LPOV1_91	0.216744	1.000000	0.089412	0.399300	-0.211419	0.025710	-0.059185	0.176666
$ LPOV3_1	0.154968	0.089412	1.000000	0.457670	-0.226173	0.013915	-0.057560	0.144844
LCO2	-0.165647	0.399300	0.457670	1.000000	0.000554	-0.472189	-0.028778	0.416057
LIDE	-0.220977	-0.211419	-0.226173	0.000554	1.000000	-0.175203	0.107440	-0.116444
LINF	-0.227902	0.025710	0.013915	-0.472189	-0.175203	1.000000	-0.034212	-0.550643
LPIB	-0.017152	-0.059185	-0.057560	-0.028778	0.107440	-0.034212	1.000000	-0.022537
LPU	0.653434	0.176666	0.144844	0.416057	-0.116444	-0.550643	-0.022537	1.000000
LTAJ	0.526538	0.287783	0.208722	0.066702	0.093524	-0.139248	-0.014518	0.535036
LUE	0.274596	0.255015	0.194614	-0.655195	-0.074166	0.565342	-0.090298	-0.340264
LDEP	-0.622753	-0.437272	-0.386163	0.404099	0.115025	-0.256776	-0.007249	0.011678
LDF	0.057127	-0.258985	-0.274410	0.330278	0.061514	-0.508943	-0.049271	0.390001
LFBC	-0.167209	-0.192547	-0.163840	0.278071	0.174104	-0.297027	-0.008009	0.278378
CHL	0.478501	0.349806	0.310655	-0.192702	-0.311803	0.043348	-0.046815	0.281923
LCER	-0.160403	-0.551713	-0.579122	-0.017235	0.273491	0.341804	0.070820	-0.627556
LCBEC	-0.467603	-0.061890	0.025036	0.622213	-0.079906	-0.251845	-0.017867	0.102219
	LTAJ	LUE	LDEP	LDF	LFBC	CHL	LCER	LCBEC
GINI	0.526538	0.274596	-0.622753	0.057127	-0.167209	0.478501	-0.160403	-0.467603
$ POV1_91	0.287783	0.255015	-0.437272	-0.258985	-0.192547	0.349806	-0.551713	-0.061890
$ POV3_1	0.208722	0.194614	-0.386163	-0.274410	-0.163840	0.310655	-0.579122	0.025036
CO2	0.066702	-0.655195	0.404099	0.330278	0.278071	-0.192702	-0.017235	0.622213
FDI	0.093524	-0.074166	0.115025	0.061514	0.174104	-0.311803	0.273491	-0.079906
INF	-0.139248	0.565342	-0.256776	-0.508943	-0.297027	0.043348	0.341804	-0.251845

GDP	-0.014518	-0.090298	-0.007249	-0.049271	-0.008009	-0.046815	0.070820	-0.017867
COULD	0.535036	-0.340264	0.011678	0.390001	0.278378	0.281923	-0.627556	0.102219
TAJ	1.000000	0.287557	-0.393472	0.034387	-0.101385	0.309117	-0.278047	-0.444202
EU	0.287557	1.000000	-0.038724	-0.542902	-0.515000	0.271294	0.379276	-0.029952
DEP	-0.393472	-0.038724	1.000000	0.538695	0.485806	-0.438228	-0.139890	0.011836
DF	0.034387	-0.542902	0.538695	1.000000	0.167907	-0.338843	-0.085541	0.181762
FBC	-0.101385	-0.515000	0.485806	0.167907	1.000000	-0.180540	-0.400536	0.556466
CH	0.309117	0.271294	-0.438228	-0.338843	-0.180540	1.000000	-0.331089	-0.283439
RECs	-0.278047	0.379276	-0.139890	-0.085541	-0.400536	-0.331089	1.000000	-0.489024
CBEC	-0.444202	-0.029952	0.011836	0.181762	0.556466	-0.283439	-0.489024	1.000000

A study of the causal relationship between FDI and poverty in the countries of North Africa requires prior perform stationary tests to determine the order of integration of each series. The results of the Levin-Lin-Chu test (LLC), Im-Pesaran-Shin (IPS), ADF and Fisher-PP-Fisher applied to the series are shown in Table 5 for the countries of the North Africa.

Acceptance or rejection of the null hypothesis of the different tests is based on the value of probability and the indicated test statistics. These probabilities are compared with a 10% threshold. If these probabilities are less than 10%, then we reject the null hypothesis and if these probabilities are greater than 10%, then we accept the null hypothesis.

For the countries of North Africa and in Table 5, we observed that only two variables LIDE, LPIB and LUE are non-stationary in level according to the test of Levin-Lin-Chu but all variables are stationary in difference first according to this test.

According to statistics of the test-Im Pesaran-Shin (IPS) test ADF-Fisher and the test of PP-Fisher, we can conclude that only four variables LIDE, LPIB, LINF and LUE are stationary in level. But first difference, all variables are stationary according to these three tests. Thereafter, all the variables are integrated of order 1. Thus, we can use the cointegration test.

Table 5. The unit root test

	Levin, Lin and Chu test		Im Pesaran and Shin test		Fisher-ADF test		Fisher-PP test	
	in level	In the first difference	in level	In the first difference	in level	In the first difference	in level	In the first difference
LGINI	0.04843	-8.49929 *	0.89018	-8.20229 *	2.29937	* 60.0539	2.40167	* 55.2620
$ LPOV1_91	-0.14884	-5.74166 *	1.42407	-4.50321 *	3.24554	* 30.8073	3.11444	* 62.9879
$ LPOV3_1	0.16586	-6.66453 *	1.83580	-5.19057 *	2.70321	* 40.9005	2.59457	* 75.6234
LCO2	-2.31532 **	-4.30995 *	0.69587	-7.07982 *	8.56954	* 69.5309	9.67859	154 030 *
LIDE	-1.34558 ***	-7.74929 *					21.3662	
			-1.45050 ***	-7.72450 *	17.4511	* 77.2053	**	110 975 *
LINF	-0.95540	-4.66477 *					19.9673	
			-1.15735	-8.10519 *	15.8569	* 80.9894	***	169 770 *
LPIB	-1.51908 ***	-8.99655 *			*		114 075	
			-6.75610 *	-15.2398 *	69.8560	143 243 *	*	147 112 *
LPU	0.27789	-3.04947 *	1.41163	-2.65498 *	8.52763	* 38.9532	5.71631	* 96.0690
LTAJ	0.92601	-6.17024 *	2.71270	-5.34750 *	1.70601	* 42.3096	1.56592	* 82.1910
LUE	0.94164	-6.57636 *				* 74.3314	20.9092	166 572 *
			0.52071	-7.52213 *	11.7411		***	
LDEP	0.10824	-4.94802 *	0.78000	-4.79169 *	6.71074	* 37.6871	6.01183	* 74.3079
LDF	-0.45709	-2.94146 *	0.07851	-4.68708 *	8.62522	* 47.3625	8.09243	* 87.9162
LFBC	-0.55114	-8.91245 *	-0.27310	-8.55507 *	12.4720	* 86.1683	12.9794	109 564 *
CHL	1.16977	-8.14926 *	0.72209	-3.48922 *	6.58552	* 36.7939	9.46106	104 902 *
LCER	0.35985	-6.81112 *	1.81424	-7.27592 *	4.81480	* 73.3678	4.84895	145 911 *
LCBEC	1.40710	-4.90207 *	0.84712	-6.38119 *	8.13605	* 62.8924	12.1554	118 134 *

Note: In this test, the p-value is compared to 10%. If the probabilities <10% therefore we reject the null hypothesis and the probabilities> 10% then we accept the null hypothesis. With the null hypothesis all series are non-stationary. (*), (**) and (***) are significant values for the 1% and 5% respectively.

5. Empirical Analysis

5.1 The Cointegration Test

We will present in this part of the test results of cointegration. Kao tests, Pedroni and Johenson Fisher cointegration are applied to ensure the long-term relationship between the variables used in this paper to examine the impact of FDI on poverty for countries of North Africa.

The Kao test is based on the statistical t-test and ADF Pedroni is based on two statistical Panel and Panel-ADF-PP individual and grouped. But Fisher's test is based on the Fisher statistical test track and Fisher Statistic of max-eigen test. The results of cointegration test for the countries of North Africa are shown in Tables 6, 7 and 8.

Indeed, the Pedroni test demonstrates the long-term relationship between FDI and poverty indicators. Thus, Kao test confirms the long term relationship between the different variables used in our paper mainly between FDI and poverty indicators. In addition, Fisher's test results confirm the presence of a long-term link between FDI and poverty in the countries of North Africa for the study period from 1985 to 2015.

According to the results of the two tables 6, 7 and 8, we have certified the existence of a cointegration relationship between the different series studied in our paper. Indeed, the result of the null hypothesis test of no cointegration was rejected at the 5% threshold, which explains the presence of a cointegration relationship. The results of these tests can determine the use of an error correction model. Also, to test the effect of FDI on poverty in the countries of North Africa, we will perform a FMOLS estimate.

Table 6. The test cointegration the impact of FDI on poverty (GINI) for the case of the countries of North Africa

Pedroni Residual Cointegration Test				Kao Residual Cointegration Test	Fisher Johansen Cointegration Test Panel			
Common AR coefs. (Within-dimension)		Individual AR coefs. (Between-dimension)		Statistics (Probability)	Fisher Stat. * (From test track)	Prob.	Fisher Stat. * (From max-eigen test)	Prob.
PP-Statistic		PP-Statistic	-9.409036	-7.486544	777.3	(0.0000) *	778.3	(0.0000) *
Panel	-8.643537	Panel	(0.0000) *	(0.0000) *				
ADF-	(0.0000) *	ADF-	-8.509099					
Statistic	-9.281424	Statistic	(0.0000) *					
Panel	(0.0000) *	Panel						

Note: (*) are significant values at a threshold of 1%.

Table 7. The test cointegration the impact of FDI on poverty ($ POV1_91) for the case of the countries of North Africa

Pedroni Residual Cointegration Test				Kao Residual Cointegration Test	Fisher Johansen Cointegration Test Panel			
Common AR coefs. (Within-dimension)		Individual AR coefs. (Between-dimension)		Statistics (Probability)	Fisher Stat. * (From test track)	Prob.	Fisher Stat. * (From max-eigen test)	Prob.
PP-Statistic		PP-Statistic	-11.45367	-10.091297	340.1	(0.0000) *	405.1	(0.0000) *
Panel	-10.85722	Panel	(0.0000) *	(0.0000) *				
ADF-	(0.0000) *	ADF-	-11.09475					
Statistic	-10.26265	Statistic	(0.0000) *					
Panel	(0.0000) *	Panel						

Note: (*) are significant values at a threshold of 1%.

Table 8. The test cointegration the impact of FDI on poverty ($ POV3_1) for the case of the countries of North Africa

Pedroni Residual Cointegration Test				Kao Residual Cointegration Test	Fisher Johansen Cointegration Test Panel			
Common AR coefs. (Within-dimension)		Individual AR coefs. (Between-dimension)		Statistics (Probability)	Fisher Stat. * (From test track)	Prob.	Fisher Stat. * (From max-eigen test)	Prob.
PP-Statistic Panel	-11.42233 (0.0000) *	PP-Statistic Panel	-12.06990 (0.0000) *	-10.56221 (0.0000) *	311.5	(0.0000) *	1311.5	(0.0000) *
ADF-Statistic Panel	-12.20179 (0.0000) *	ADF-Statistic Panel	-17.72650 (0.0000) *					

Note: (*) are significant values at a threshold of 1%.

5.2 The Estimation Results FMOLS

The panel FMOLS method proposed by Pedroni (1996, 2000) solves problems of heterogeneity in the sense that it allows the use of heterogeneous cointegrating vectors. For Maeso-Fernandez et al. (2004), FMOLS estimator takes into account the presence of the constant term and the possible existence of correlation between the error term and differences estimators.

Adjustments are made to this effect on the dependent variable and long-term parameters obtained by estimating the fitted equation. In the case of panel data, the long-term coefficients from the FMOLS art are obtained by the average group of estimators with respect to the sample size (N).

In addition, the coefficients of determination for the two estimates are greater than 0.7, therefore, the three estimated models are characterized by a good linear fit.

For FMOLS estimate of the first indicator of poverty, we noticed that there are eight significant variables, but with different signs (Table 9).

Table 9. Estimation FMOLS for variable LGINI

Variable	Coefficient	Std. error	Does Statistic	Prob.
LIDE	-0.007476	0.003124	-2.393038 **	0.0179
LCO2	0.060745	0.032014	1.897425 ***	0.0596
LINF	-0.000189	0.000302	-0.626424	0.5319
LPIB	0.000605	0.000447	1.352522	0.1781
LPU	0.053411	0.118210	0.451830	0.6520
LTAJ	-0.061336	0.085759	-0.715211	0.4755
LUE	0.196829	0.051642	3.811434 *	0.0002
LDEP	-0.130498	0.044162	-2.954995 *	0.0036
LDF	0.030973	0.009888	3.132484 *	0.0021
LFBC	0.002445	0.001284	1.904263 ***	0.0587
CHL	0.075868	0.036236	2.093717 **	0.0379
LCER	0.006174	0.029475	0.209457	0.8344
LCBEC	0.030269	0.008532	3.547531 *	0.0005
R-squared	0.965496			
Adjusted R-squared	0.961638			

Note: (*), (**) and (***) are significant values for the 1%, 5% and 10% respectively

We found that, statistically significant and positive at a 1% level. Noula LIDE variable measuring foreign direct investment has a negative impact on the Gini index to a threshold of 5%. That is to say, if the level of FDI increased by 5 units, then the GINI index decreases by 0.007476 units.

Indeed, CO_2 emissions have a significant positive impact on the Gini index to a 10% threshold. This means that if CO_2 emissions increase of 5 units while poverty increases 0.060745 units at time t in the case of the North African country.

ECL variable which measures the level of energy consumption is statistically significant and positive at a 1% level. So if energy consumption increases by one then, poverty increases 0.196829 units.

We noticed, is statistically significant and positive at a 1% level. Noula LDEP variable measuring government spending has a negative impact on poverty as measured by the GINI index. That is to say, if the level of public spending increases of 10 units, then, poverty decreases by 0.130498 units.

So, we notice that the LDF variable that measures the financial development has a positive and significant impact on poverty at a threshold of 1%. That is to say, if the level of financial development increases by one, then, poverty increases 0.030973 units.

The LFBC variable that measures the gross formation of capital stock also has a positive and significant impact on the Gini index to a threshold of 1%. That is to say, if the level of gross fixed capital stock increases by one, then, poverty increases 0.002,445 units.

CHL variable that measures the unemployment rate in each country is also positive and statistically significant at a threshold of 5%. So if unemployment rate rises of five units then, poverty in the countries of North Africa increases 0.075868 units.

The LCBEC variable that measures the market capitalization of listed companies is statistically significant and positive at a 1% level. So if the market capitalization of listed companies increased by one then, poverty increases 0.030269 units.

For FMOLS estimate of the second indicator of poverty ($ LPOV1_91), we noticed that there are four significant variables, but with different signs (Table 10).

We notice that the LTAJ variable that measures the youth literacy rate has a negative impact on poverty as measured by the poverty gap of $ LPOV1_91. That is to say, if the youth literacy rate increased by 5 units, then the poverty gap decreases LPOV1_91 $ 2.059331 units.

So we remark that the LDF variable that measures the financial development has a positive and significant impact on the poverty gap of $ LPOV1_91 a threshold of 1%. That is to say, if the level of financial development increases by one, then, poverty increases 0.384065 units.

The LFBC variable that measures the gross formation of capital stock also has a positive and significant impact on the poverty gap of $ LPOV1_91 a threshold of 5%. That is to say, if the level of gross fixed capital stock increases by five units, then the poverty gap increases by $ LPOV1_910.028908 units.

CHL variable that measures the unemployment rate in each country is also positive and statistically significant at a threshold of 5%. So if unemployment rate rises of five units then the poverty gap of $ LPOV1_91 in the countries of North Africa increases 0.075868 units.

For FMOLS estimate of third indicator of poverty ($ LPOV3_1), we noticed that there are four significant variables, but with different signs (Table 11).

We notice that the LTAJ variable that measures the youth literacy rate has a negative impact on poverty as measured by the poverty gap of $ LPOV3_1. That is to say, if the youth literacy rate increased by 5 units, then the poverty gap decreases LPOV3_1 $ 1.284032 units.

So we notice that the LDF variable measuring financial development has a positive and significant impact on the poverty gap of $ LPOV3_1 a threshold of 5%. That is to say, if the level of financial development increases of five units, then, poverty increases 0.169685 units.

The LFBC variable that measures the gross formation of capital stock was also a positive and significant impact on the poverty gap of $ LPOV3_1 a threshold of 1%. That is to say, if the level of gross fixed capital stock increases by one, then the poverty gap increases by $ LPOV3_10.024755 units.

CHL variable that measures the unemployment rate in each country is also positive and statistically significant at a threshold of 1%. So if unemployment rate rises by one while the poverty gap of $ LPOV3_1 in the countries of North Africa increases 0.773105 units.

Table 10. Estimated FMOLS for the variable $ LPOV1_91

Variable	Coefficient	Std. error	Does Statistic	Prob.
LIDE	-0.043698	0.034938	-1.250710	0.2129
LCO2	-0.136463	0.358038	-0.381142	0.7036
LINF	0.000880	0.003381	0.260174	0.7951
LPIB	0.005690	0.005001	1.137808	0.2569
LPU	0.846147	1.322026	0.640039	0.5231
LTAJ	-2.059331	0.959096	-2.147157 **	0.0333
LUE	0.649806	0.577543	1.125121	0.2622
LDEP	0.313307	0.493891	0.634364	0.5267
LDF	0.384065	0.110582	3.473121 *	0.0007
LFBC	0.028908	0.014357	2.013556 **	0.0457
CHL	1.185640	0.405251	2.925694 *	0.0039
LCER	0.041089	0.329641	0.124649	0.9010
LCBEC	0.098474	0.095424	1.031962	0.3036
R-squared	0.936950			
Adjusted R-squared	0.929901			

Note: (*), (**) and (***) are significant values for the 1%, 5% and 10% respectively

Table 11. Estimated FMOLS for the variable $ LPOV3_1

Variable	Coefficient	Std. error	Does Statistic	Prob.
LIDE	-0.036537	0.022739	-1.606815	0.1101
LCO2	0.000959	0.233022	0.004116	0.9967
LINF	-0.000476	0.002200	-0.216293	0.8290
LPIB	0.003442	0.003255	1.057469	0.2919
LPU	-0.030729	0.860415	-0.035714	0.9716
LTAJ	-1.284032	0.624210	-2.057053 **	0.0413
LUE	0.515212	0.375883	1.370671	0.1724
LDEP	-0.178584	0.321440	-0.555577	0.5793
LDF	0.169685	0.071970	2.357706 **	0.0196
LFBC	0.024755	0.009344	2.649336 *	0.0089
CHL	0.773105	0.263750	2.931206 *	0.0039
LCER	0.000318	0.214541	0.001481	0.9988
LCBEC	0.070929	0.062105	1.142086	0.2551
R-squared	0.939816			
Adjusted R-squared	0.933088			

Note: (*), (**) and (***) are significant values for the 1%, 5% and 10% respectively

5.3 The Causality Test

We need to check if the IDE cause the movements of poverty or poverty because FDI in the countries of North Africa.

Acceptance or rejection of the null hypothesis of Granger causality test is based on a threshold of 5%. If the probability of the test is less than 5% in this case we reject the null hypothesis and if the probability is greater than 5% then we accept the null hypothesis of no causality.

Tables 12, 13, and 14 summarize all the results of causality test for the three indicators of poverty for those countries of North Africa and the study period of 1985 to 2015.

According to Table 12, we noticed that there is a unidirectional relationship between the consumption of energy and poverty Granger (0.9956> 0.0102 and 5% <5%). Only the GINI index can cause Granger consumption of energy.

Thus there is no causal relationship between the Gini index and other senses to control variables Granger as their probability values are greater than 0.05, which allow accepting the null hypothesis of the test.

Table 12. The causality test for variable LGINI

Null Hypothesis:	Obs	F-Statistic	Prob.
CO2 does not Granger Cause GINI	174	0.02150	0.9787
GINI does not Granger Cause CO2		2.05242	0.1316
FDI does not Granger Cause GINI	174	0.06502	0.9371
GINI does not Granger Cause IDE		1.40501	0.2482
INF does not Granger Cause GINI	174	0.16511	0.8479
GINI does not Granger Cause INF		0.22829	0.7961
GDP does not Granger Cause GINI	174	0.05708	0.9445
GINI does not Granger Cause GDP		1.45896	0.2354
PU does not Granger Cause GINI	174	0.00394	0.9961
GINI does not Granger Cause PU		0.01741	0.9827
TAJ does not Granger Cause GINI	174	0.71878	0.4888
GINI does not Granger Cause TAJ		0.02269	0.9776
EU does not Granger Cause GINI	174	0.00440	0.9956
GINI does not Granger Cause EU		4.70942	0.0102
DEP does not Granger Cause GINI	174	0.92156	0.3999
GINI does not Granger Cause DEP		0.07589	0.9270
DF does not Granger Cause GINI	174	0.30542	0.7372
GINI does not Granger Cause DF		0.92725	0.3976
BCF does not Granger Cause GINI	174	0.41309	0.6623
GINI does not Granger Cause FBC		1.46845	0.2332
CH does not Granger Cause Gini	174	0.03707	0.9636
Gini does not Granger Cause CH		0.59528	0.5526
REC does not Granger Cause GINI	174	0.30342	0.7387
GINI does not Granger Cause CER		0.30986	0.7340
CBEC does not Granger Cause GINI	174	0.87943	0.4169
GINI does not Granger Cause CBEC		0.58106	0.5604

According to Table 13, we noticed that there is no causal relationship between poverty gap to $ 1.91 and the other control variables Granger as their probability values are greater than 0.05, which allow accepting the null hypothesis of the test.

According to Table 14, we noticed that there is no causal relationship between poverty gap of $ 3.1 and other control variables Granger as their probability values are greater than 0.05, which allow accepting the null hypothesis of the test.

Table 13. The causality test for the variable $ LPOV1_91

Null Hypothesis:	Obs	F-Statistic	Prob.
CO2 does not Granger Cause $ POV1_91	174	0.29971	0.7414
$ POV1_91 does not Granger Cause CO2		0.41057	0.6639
FDI does not Granger Cause $ POV1_91	174	0.83992	0.4335
$ POV1_91 does not Granger Cause IDE		2.24868	0.1087
INF does not Granger Cause $ POV1_91	174	0.20629	0.8138
$ POV1_91 does not Granger Cause INF		0.11658	0.8900
GDP does not Granger Cause $ POV1_91	174	0.25314	0.7767
$ POV1_91 does not Granger Cause GDP		1.04794	0.3529
PU does not Granger Cause $ POV1_91	174	0.21266	0.8086
$ POV1_91 does not Granger Cause PU		0.12238	0.8849
TAJ does not Granger Cause $ POV1_91	174	0.18553	0.8308
$ POV1_91 does not Granger Cause TAJ		0.76788	0.4656
EU does not Granger Cause $ POV1_91	174	0.71114	0.4925
$ POV1_91 does not Granger Cause EU		0.70694	0.4946
DEP does not Granger Cause $ POV1_91	174	2.11998	0.1232
$ POV1_91 does not Granger Cause DEP		0.92243	0.3995

DF does not Granger Cause $ POV1_91	174	1.07477	0.3437
$ POV1_91 does not Granger Cause DF		1.78316	0.1713
BCF does not Granger Cause $ POV1_91	174	0.09534	0.9091
$ POV1_91 does not Granger Cause FBC		0.23879	0.7878
CH does not Granger Cause $ POV1_91	174	0.40424	0.6681
$ POV1_91 does not Granger Cause CH		0.42171	0.6566
REC does not Granger Cause $ POV1_91	174	0.00168	0.9983
$ POV1_91 does not Granger Cause CER		0.83364	0.4362
CBEC does not Granger Cause $ POV1_91	174	0.10968	0.8962
$ POV1_91 does not Granger Cause CBEC		0.06561	0.9365

Table 14. The causality test for the variable $ LPOV3_1

Null Hypothesis:	Obs	F-Statistic	Prob.
CO2 does not Granger Cause $ POV3_1	174	0.27003	0.7637
$ POV3_1 does not Granger Cause CO2		0.25712	0.7736
FDI does not Granger Cause $ POV3_1	174	1.02480	0.3611
$ POV3_1 does not Granger Cause IDE		2.79780	0.0638
INF does not Granger Cause $ POV3_1	174	0.33738	0.7141
$ POV3_1 does not Granger Cause INF		0.04963	0.9516
GDP does not Granger Cause $ POV3_1	174	0.17519	0.8395
$ POV3_1 does not Granger Cause GDP		0.97517	0.3792
PU does not Granger Cause $ POV3_1	174	0.65283	0.5219
$ POV3_1 does not Granger Cause PU		0.13932	0.8701
TAJ does not Granger Cause $ POV3_1	174	1.10604	0.3332
$ POV3_1 does not Granger Cause TAJ		0.45709	0.6339
EU does not Granger Cause $ POV3_1	174	0.67018	0.5130
$ POV3_1 does not Granger Cause EU		0.68672	0.5046
DEP does not Granger Cause $ POV3_1	174	1.52760	0.2200
$ POV3_1 does not Granger Cause DEP		0.48908	0.6141
DF does not Granger Cause $ POV3_1	174	1.24358	0.2910
$ POV3_1 does not Granger Cause DF		1.60294	0.2043
BCF does not Granger Cause $ POV3_1	174	0.01918	0.9810
$ POV3_1 does not Granger Cause FBC		0.19131	0.8261
CH does not Granger Cause $ POV3_1	174	0.68399	0.5060
$ POV3_1 does not Granger Cause CH		0.48737	0.6151
REC does not Granger Cause $ POV3_1	174	0.08870	0.9152
$ POV3_1 does not Granger Cause CER		0.17997	0.8355
CBEC does not Granger Cause $ POV3_1	174	0.05286	0.9485
$ POV3_1 does not Granger Cause CBEC		0.07029	0.9322

6. Conclusion

Thus, this paper has been devoted to relevant empirical study to clarify the impact of FDI on poverty in the case of the North African country during the period from 1985 to 2005. The sample used in our paper consists of 6 countries of North Africa during the period from 1985 to 2005.

We conduct a descriptive analysis based on the interpretation of descriptive statistics, correlation test and the unit root test. We concluded that on the basis of the test statistics of Im-Pesaran-Shin (IPS) test ADF-Fisher and the test of PP-Fisher, we can conclude that only three variables LIDE, LPIB, LINF and are stationary in LUE level. But first difference, all variables are stationary according to these three tests. Thereafter, all the variables are integrated of order 1. Thus, we can use the cointegration test. We interpreted the results of cointegration test, model error correction, the estimated FMOLS model and Granger causality test.

For the co-integration test, we have certified the existence of a cointegration relationship between the different series studied in our paper. Indeed, the results of the null hypothesis test of no cointegration were rejected at the 5% threshold, which explains the presence of a cointegration relationship. The results of these tests can determine the use of an error correction model. Also, to test the effect of FDI on poverty in the countries of North Africa, we will perform a FMOLS estimate.

Thus, for the short-term dynamics, we noticed that FDI have a positive and significant impact on a threshold of 1% on the GINI index for the case of the countries of North Africa and a significant negative a threshold of 1% for the other two indicators of poverty; LPOV1_91 $ and LPOV3_1 $.

Then we found that the LIDE variable measuring foreign direct investment has a negative impact on the Gini index to a threshold of 5%. That is to say, if the level of FDI increased by 5 units, then the GINI index decreases by 0.007476 units.

Finally, Granger causality test, we noticed that there is a unidirectional relationship between the consumption of energy and poverty Granger. Only the GINI index can cause Granger consumption of energy.

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