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An Econometric Study of the Impact Economic Growth, Human Capital and Environmental Degradation on FDI Inflows in the African Mediterranean Countries

Mohamed Abdouli* and Sami Hammami

Faculty of economics and Management of Sfax, Tunisia

Abstract

This paper aims to examine the role of economic growth, human capital and the environment in attracting FDI inflows using the dynamic (Sys-GMM) panel data approaches for a panel of 4 African Mediterranean countries over the period 1990–2013. Our empirical results pointed out that higher human capital attracts FDI inflows in the African Mediterranean countries. They also indicate that weak environmental regulations increase FDI inflows. On the other hand our findings demonstrated that FDI inflows in African Mediterranean countries do no react to the economic growth.

Keywords: Economic growth; Human capital; FDI inflows; CO_2 emissions; Dynamic panel data

Introduction

Over the past two decades, (FDI) has become an increasingly important substance as a source of capital, technology, and management for the developing countries. FDI inflow is widely believed to be crucial to economic growth enhancement [1] as it brings capital, technology and know/how into the host country. It is supposed to increase the existing stock of knowledge by transferring it [2] into the host countries through labor training and the transfer of skills, and new managerial and organizational practice. Moreover, could increase business transactions and speed the rhythm of economic growth [3]. However, FDI inflow enhances the productivity of the host countries and promotes economic growth [4], as well as, can provide education and training actively, bring new skills, technology, and knowledge which give an advantage to Human Capital Development [5,6]. Indeed, the attractiveness of FDI has become a topical issue, as all the countries of the world, without exception, make the attraction of foreign firms a priority in their industrial policy. In fact, several factors lead to attracting more FDI inflows such as economic growth, environment degradation, and human capital. For it, there are some economists who believe that economic growth plays a pivot role in attracting FDI inflows [7]. Hence, it is an important determinant of the FDI inflows [8], as well as, the level of human capital may affect the geographical distribution of FDI this implies that the skill and education level of labor can influence the volume of FDI inflows [9,10]. Furthermore, the environmental degradation positively affects FDI inflows [11] (*pollution haven hypothesis*)[1]. According to the pollution haven hypothesis, there is a positive relationship between FDI inflows and loose environmental laws [12]. In addition, the environmental degradation linked negatively to FDI inflows. This implies that the host countries applied stringent environmental regulation to attract FDI inflows since the latter is all polluting [13] (*pollution halo hypothesis*)[2].

This paper is an attempt to examine the impact of economic growth, human capital and environmental regulations on FDI inflows, along with of one other variable, such as, energy consumption in selected African Mediterranean countries, including Algeria, Egypt, Morocco, and Tunisia, for the period 1990–2013 using both static and dynamic panel data approaches. They all have the same level of economic structure. Therefore, this article attempts to answer this question: How do economic growth, Human capital and environmental quality affect the FDI inflows in the African Mediterranean countries??

In what follows, the structure of the discussion in this paper is organized as follows. Section 2 the literature will be expressed. Section 3 outlines the econometric modeling approach and describes the used data. Section 4 reports and discusses the empirical results. Section 5 concludes the article and offers some policy implications.

Literature Review

Several studies have investigated the relationship between economic growths, human capital and CO_2 emissions on FDI inflows. However, the effect of economic growth, human capital and CO_2 emissions on FDI inflows has been well-studied.

This literature can be divided into sub-titles to show each variable affects FDI inflows. Thus this paper reviews the literature under three parts, firstly (a) economic growth and FDI inflows; Secondly (b) CO_2 emission and FDI inflows. (c) Thirdly, Human capital and FDI inflows. We discuss them in turn below.

Economic growth and FDI inflows

There are many studies which tested the effect of economic growth on FDI inflows, for example, Bende-Nabende and Ford [14] tested the relationship between economic growth, FDI, capital stock, technology, human capital and government policies in Taiwan for the period 1959-1995 using the ordinary least squares (OLS) indications. The empirical

[1]This happens when polluting FDI are concentrated in developing countries as a result of lax environmental laws (pollution haven hypothesis).

[2]The pollution halo hypothesis implies that FDI has the potential of transferring superior technologies from more developed to less developed economies.

***Corresponding author:** Mohamed Abdouli, Faculty of economics and Management of Sfax, Tunisia, Tel: 0021655586407, 00216 55194 142; E-mail: mahmedabdouli3@gmail.com

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results found that economic growth has a significant effect in attracting FDI. Choe [8] investigated the link between foreign direct investment and economic growth. The author found that higher economic growth attracts more foreign direct investment. Likewise, for 23 developing countries, Hsiao and Shen [15] analyzed the factors determining foreign direct investment from the period 1976-1997. Their results showed that that economic growth is one of the important factors in attracting FDI, particularly in the developing countries. However, Li and Liu [16] used data from 84 both developed and developing countries over the period 1970–1999. Their findings indicated that FDI and economic growth became significantly complementary. In addition, Nguyen and Nguyen [7] tested the determinants of FDI inflow and its impacts on the economy in Vietnam for the period 1988-2006 using the OLS model. The author shows that the increase of economic growth sends positive signals to attract further FDI. Similarly, in high and Low-income countries, Ozturk [17] investigated the causality between FDI and economic growth for the period 1970-2000. Ozturk found that economic growth has a great importance in attracting FDI.

Indeed, using simultaneous equation, Anwar and Sun [18] examined the interrelationship between economic growth, the stock of foreign investment and the stock of domestic capital in Malaysia for the period 1970-2007. The authors' show that the stock of foreign investment in Malaysia is significantly affected by the level of the economy.

In a more recent study, about mena countries, Abdouli and Hammami [19] show that economic growth correlated positively with FDI inflows. Using an ordinary least square (OLS) method for the period 1960-2009, Kinuthia and Murshed [20] investigated the determinants of foreign direct investment in Malaysia and Kenya. Their results showed that Malaysia's success in attracting huge FDI inflows is higher than that of Kenya. Hence, Omri and Sassi-Tmar [21] tested the relationship between foreign direct investment (FDI) inflows and economic growth for three African economies, namely, Tunisia, Morocco, and Egypt during 1985-2011 period, using the generalized method of moments (GMM). The authors show that high economic growth in these economies does send positive signals to prospective foreign investors

Environmental degradation and FDI inflows

The relationship between FDI and pollution is validated according to pollution haven hypothesis and pollution halo hypothesis. Several studies have developed these hypotheses. So, we can be divided the literature into two strands. The first focuses on the validity of the pollution haven hypothesis. This implies that a country has applied weak environmental regulations to attract FDI inflows [22] (pollution haven hypothesis). Therefore, many studies tested the influence of the environmental regulations on FDI inflows under the pollution haven hypothesis. First of all, Jaffe et al. [23] tested the relationships between the environmental regulations, innovation and improved competitiveness of the U.S. Manufacturing for the period 1970-1991. Their finding showed that environmental regulations stimulate innovation and improve sector competitiveness.

Furthermore, using fixed, random and OLS effects, Jeppesen et al. [24] tested the relationship between new manufacturing plant location decisions and environmental regulations for the period 1963-1994. The empirical results show that foreign firms are more sensitive than to domestic ones the environmental regulations.

In developing countries for the period 1989-1994, Cole and Elliott [25] investigated the relationship between FDI inflows and the environmental regulations. The authors' show that the capital flows from Japan to the Southeast Asian countries is likely to increase the level of CO_2 emissions in the recipient countries because most of the investments are focused on heavy and polluting industries.

For the period 1995 -2005, Leiter et al. [26] examined the relationship between environmental regulation and the firm's behavior in European Country, using fixed effects. They found that the diminishing of the environmental regulation attracts the FDI inflows.

In the same context, Wang et al. [27] and Hitam and Borhan [28] tested the relationship between foreign direct investment and the environmental degradations in Malaysia and China, during the period 1999–2005 and 1965-2010, respectively. The results indicated that the same positive relationship between FDI and CO_2 emissions is found for Malaysia and China. These findings revealed that less developed countries are always the best choice for investment due to the low stringent environmental policies [29].

Other studies, Rezza [30] analyzed the determinants of foreign direct investment (FDI) and how it is affected by the stringency of the environmental regulations in the host countries over the period 1999 -2005. The authors show that polluting industries tend to invest more in countries with laxer environmental regulations in terms of both the amount of investment and the number of new foreign affiliates. For South Korea, over the periods 2000-2007, using fixed effects (FE) estimation, Chung [31] examined the effect of environmental regulations on foreign direct investment (FDI). The empirical results showed that polluting industries tend to invest more in countries with laxer environmental regulations.

Recently, Abdouli and Hammami [32] also show that similar results in the Middle East and North Africa countries.

The second focuses on the validity of the pollution halo hypothesis. Of studies found that the multinational Firms (MNFs) that already have international experience appear to be the most likely to reorganize their production activities in countries that have more stringent environmental regulation. For example, for the period 1993-1996, Dean et al. [11] applied the logit model on Chinese, to test the relationship between FDI inflows and two indicators of environmental stringency. Mulatu et al. [33] investigated the effect of environmental regulation on industry location in Europe for the period 1990-1994, using Johnson–Neyman technique. The authors concluded that the environmental regulation has significant negative effect on industry location. For the 1992-1997 period, Kirkpatrick and Shimamoto [34] used a logit model to examine the impact of the environmental regulations in host countries on the Japanese foreign direct investment (FDI) decision-making. The empirical results support the pollution halo hypothesis. This implies that inward Japanese FDI appears to be attracted to countries which have committed themselves to a transparent and stable environment regulatory environment. Similarly, for period 2000-2006, Kneller and Manderson [35] examined the relationship between environmental regulations and innovation, using data from the UK manufacturing industry, using the generalized method of moments (GMM) estimators. The findings show that the more stringent the environmental regulations the lower the optimal expenditure on the non environmental innovations.

In the same veins, Ben-Kheder and Zugravu [36] tested the effect of the environmental regulations on the firms' location choice for the developed, most of emerging and central and Eastern European. They found that more stringent environmental regulations seem to attract.

Human capital and FDI inflows

There are many studies which examined the influence of Human capital on FDI inflows. For example, Li and Liu [16] supported the importance of human capital for absorptive capacity of FDI effects for 84 countries for the period 1970-1999. They found that the higher the technology gap between the source and the receiving country the lower the ability of the host country to benefit from FDI. Similarly, De Simone and Faini explored the links between FDI and education for 112 countries and 108 countries. The authors show that FDI inflows affected positively by the secondary enrollment. Majeed and Ahmad have test the influence of human capital on attracting FDI in 23 developing countries over 35 years period 1970-2004, by using fixed effects model. The results showed that human capital has a positive and significant effect on FDI inflows.

For 78 firms in 2008, Heyuan and Teixeira use logit model to test the direct and indirect impacts of human capital on FDI on microeconomic level. Their finding showed that human capital has no direct effect on FDI for Chinese case when human capital is measured by academic qualifications. However, there is a positive indirect effect on FDI through R&D efforts.

Indeed, for India Kar tested the causal link between FDI and human capital development in India. Their finding showed that allocation of more resources for primary education may be more rewarding in the long run through development of a strong human capital base acting as a catalyst for attracting the global investors.

Recently, Emmanuel et al. [37] investigated the role of human capital (HK) on FDI inflows in the sub-Saharan Africa over the period 1980–2012 using OLS, fixed and random effect models. The empirical result also indicates that show that all measures of HK have a significant influence on FDI inflows.

Econometric Method and Data

Econometric method

The role of economic growth, environment and Human capital in FDI inflows to African Mediterranean countries is examined by estimating various versions of the following model, which may be expressed in an implicit form as follows. Thus, our proposed model, which seems to be consistent with the broader literature on the determinants of FDI inflows cited above, takes the following form:

$$FDI=(GDP, CO_2, HK)^{\alpha} \quad (1)$$

The logarithmic transformation of Eq. (1) is given by:

$$Log\,(FDI_t)=\alpha_0+\alpha_1\,Log\,(GDP)+\alpha_2\,Log\,(CO_2)+\alpha_3\,Log\,(HK)+\varepsilon_t \quad (2)$$

Can be written in panel data form as follows Eq. (2) because since our study is a panel data study:

$$Log\,(FDI_{it})=\alpha_0+\alpha_{1it}\,Log\,(GDP)+\alpha_{2i}\,Log\,(CO_{2it})+\alpha_3\,Log\,(HK_{3it})+\varepsilon_{i,t} \quad (3)$$

The subscript i=1,…, n denotes the country (N=4 in our study) and t=1,…, T denotes the time period, and Log (GDP) represents the GDP per capita, Log (FDI) the foreign direct investment, Log (CO_2) the per capita CO_2 emissions and Log (HK_{3it}) the Human Capital; Human capital equal of Gross enrolment ratio, secondary, both sexes (%)+Gross enrolment ratio, tertiary, both sexes (%).

Eq. (3) postulates that economic growth, the environmental degradation, and the human capital have a great impact on FDI flows (for example, Pao and Tsai, [38]; Anwar and Sun [2]; Olusanya and Olumuyiwa [39]; Emmanuel et al. [37].

Estimation procedure

In this study, dynamic panel estimation techniques are estimated by the generalized method of moments (GMM) to estimate our dynamic panel data model which also allows for the lagged level of economic growth. This method uses a set of instrumental variables to solve the endogeneity problem of the repressors. The system-GMM estimator (sys-GMM) includes not only the previous instruments but also the lagged values of the dependent variable. It helps solve the endogeneity problem arising from the potential correlation between the independent variable and the error term in dynamic panel data models. It also permits to deal with omitted dynamics in static panel data models, owing to the ignorance of the impacts of lagged values of the dependent variable.

Panel unit root tests

We begin our analysis with the implementation of the panel unit root tests. In panel data analysis, the panel unit root test must be taken first in order to identify the stationary properties of the relevant variables. In this study, we choose two panel unit root tests, Levine et al. and Im et al. (IPS) [40]. The null hypothesis of the above two unit root tests is that there exist unit root (i.e. the variables are non-stationary), whereas the alternative hypothesis states that no unit root exists in the series (i.e. the variables are stationary) (Table 1).

Table 1 shows the results of panel unit root tests for the levels of variables. It can be seen that all the variables in level are statistically significant under the LLC and IPS tests, indicates that all variables are integrated of order zero, I (0).

Data

We use annual data for the FDI inflows, GDP, CO_2 emissions, Human Capital (HK), and all the data, collected for the period 1990–2013, are sourced from the World Bank's World Development Indicators. Our study covers 4 countries selected on the basis of data availability. They include: 4 African Mediterranean countries**,** namely, Algeria, Morocco, Tunisia, and Egypt.

Descriptive statistics

Table 1 shows the descriptive statistics of the variables used in our estimation. On average, this table provides a statistical summary associated with the actual values of the used variables for each country. The highest means of CO_2 emissions (2842.802) in Tunisia and (2802.265) in Algeria, whereas the highest means of FDI inflows (2.824) and (2.225) is in Egypt and Tunisia, respectively. However, the highest means of real GDP and Human capital are 2842.802 in Tunisia

	LLC test		IPS test	
	Level		Level	
	T-Statistics	p-value	T-Statistics	p-value
g(FDI)	-3.31226*	(0.0005)	3.77503*	(0.0001)
g(GDP)	6.06489*	(0.0000)	-3.29595*	(0.0005)
g(CO2)	-1.81902**	(0.0345)	-3.99028*	(0.0000)
g(HK)	-1.34412***	(0.0895)	1.15572**	(0.0391)

Note: All panel unit root tests were performed with restricted intercept and trend for all variables.
Lag length of Variables is shown in small parentheses. *, **and *** indicate significance at the 1%, 5%, and 10%levels, respectively.

Table 1: Results of panel unit root tests.

and 85.647 are in Egypt, respectively. The lowest means of FDI inflows (1.009) and GDP (1560.168) are in Algeria and Egypt, respectively. Then, the lowest mean of Human capital and CO_2 emissions (2.752) is in Algeria and (1.351) in Morocco, respectively (Table 2).

Additionally, Egypt has the highest volatility (defined by the standard deviation) in FDI inflows (2.575). However, the lowest volatility of FDI inflows (0,617) is in Algeria. It is also noted that the Tunisia is lowest volatile in real GDP and CO_2 emissions; with a variation coefficient of 0.350 and 0.134, respectively, which is the lowest compared to other countries' coefficients of variation. Moreover, we can see that the Tunisia is lowest volatile in Human capital; its coefficient of variation of 0.487. In addition, the highest coefficient of variation of Human capital, when compared to other countries' coefficient of variation is 21,636 of Egypt.

Overall, the African Mediterranean region have the greatest means in the real GDP and human capital. As well, the greatest volatilities in real GDP and human capital. Besides lowest volatile are in the CO_2 emissions and FDI inflows.

Results and Discussions

Results of dynamic panel estimations

We have in this study a dynamic panel specification where lagged levels of FDI inflows are taken into account by using Sys-GMM estimator. The consistency of the GMM estimator depends on the validity of the instruments.

To address this issue, two specification tests are considered. The first is the sargen test of over-identifying restrictions, which tests the overall validity of the instruments (the null is that the instruments are valid). The second is the second-order autocorrelation test for error term, which tests the null hypothesis according to which there is no autocorrelation.

Table 3 reports the determinants of FDI inflows using a GMM-system estimator proposed by Blundell and Bond. This econometric technical is very common in FDI inflows studies [32,35,41] demonstrate that GMM-system permit solve the endogeneity between variables. The

Panels	Descriptive statistics	FDI (net inflows)	GDP	CO2	Human Capital
Egypt	Mean	2,225	1560,168	2,018	85,647
	Std. Dev.	2,575	789,002	0,474	21,636
	CV	1,157	0,506	0,235	0,253
Algeria	Mean	1,009	2802,265	3,109	2,752
	Std. Dev.	0,617	1456,848	0,249	2,584
	CV	0,612	0,520	0,080	0,939
Morocco	Mean	1,560	1909,192	1,351	48,795
	Std. Dev.	1,323	704,443	0,293	14,097
	CV	0,848	0,369	0,217	0,289
Tunisia	Mean	2,824	2842,802	2,119	21,173
	Std. Dev.	1,852	995,269	0,285	10,315
	CV	0,656	0,350	0,134	0,487
Panels	Mean	1,924	2262,007	2,152	39,638
	Std. Dev.	1,885	1158,764	0,713	34,405
	CV	0,980	0,512	0,331	0,868

Notes: Std. Dev.: indicates standard deviation, CO_2: indicates carbon dioxide emissions, GDP indicate economic growth, FDI indicate FDI inflows, HK indicates level of Human capital, CV indicates the coefficients of variation (standard deviation/to/mean ratio), respectively.

Table 2: Summary statistics (before Taking growth rate), 1990-2013.

Independent variables	Dependent variable: FDI inflows (FDI)	
	Sys-GMM	
FDI(t-1)	0.224*	(0.000)
GDP	0.1587	(0.614)
CO2	0.669*	(0.000)
HK	0.659*	(0.000)
Intercept	4.809*	(0.000)
Observations	84	
No. countries	4	
AR(1) test (p-value)	-2.18	(0.029)
AR(2) test (p-value)	0.98	(0.329)
SargenJ-test (p-value)	81.21	(0.473)

Notes: Values in parenthesis are the estimated p-values.
AR(1) and AR(2) are tests for autocorrelation in differences.
Sargan test/test refers to the over/identification test for the restrictions in GMM estimation.
*Coefficient significant at the 1% level.

Table 3: Results of Sys-GMM.

regression permits to conclude that we have not problems with serial correlation (Ar_2); this test was proposed by Arellano and Bond [42].

The Sargan test demonstrates that the instruments used in this regression are correct. The coefficient of lagged dependent variable (FDI inflows) presents a positive sign, showing that FDI inflows is a dynamic process, and the variable is statistically significant at 1% level. The empirical studies of Kneller and Manderson [35] and Abdouli and Hammami [19] also found a positive effect.

The variable human capital has a positive effect on FDI inflows, and the variable is statistically significant at 1% level. This implies that a 1% level increase in human capital attract more FDI inflows by around 0.659%. This result is according to previous studies [37].

The CO_2 emissions present a positive and statistically significant effect on FDI inflows at the 1% level. A 10% level increase in CO_2 emissions increase FDI inflows by around 0.669%. However, African Mediterranean countries applied weak environmental regulations to attract FDI inflows (pollution haven hypothesis). It follows that the results are consistent with those of Dean et al. [11] for the developing countries and Chung [31] for South Korea. Finally, regarding the GDP variable has insignificant impact on FDI inflows [43].

Conclusions and Policy Implications

The objective of present study is to test the impact of economic growth, Human capital and the environment on foreign direct investment in the African Mediterranean countries over the period 1990-2013 using the dynamic panel estimation (system GMM) [44-48].

Our dynamic result (system GMM) shows that the coefficient of lagged FDI inflows t policy makers in these countries consider that more prudent polkeys an important role in attracting FDI inflows in the African Mediterranean countries [49-52]. This suggests thaicies might involve eliminating barriers that prevent local firms from establishing adequate linkages, improving local firms' access to inputs, technology, and financing, and streamlining the procedures associated with selling input.

In addition, the environmental quality has an impact on the FDI inflows. In fact, foreign investors tend to invest in areas with low environmental regulation. However, it's obligatory for the African Mediterranean countries to discover new technique environmental to attract FDI inflows without impedes environmental quality (Halo pollution hypothesis) [53-57].

Concerning, the human capital, this latter has an important in encouraging FDI inflows. In fact, the African Mediterranean countries invest in human capital to promote the economic growth, as well as, gives good conditions to attract more FDI inflows.

The overall policy from our study it's obligatory for these countries to invest in human capital to discovers new technique respectful to the environment and sound economic and exterior policies to support economic development and improve the environment quality with strong of foreign capital.

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