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The attractiveness of foreign direct investment in North African countries

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Abstract :

The aim of this study is to identify the main determinants of foreign direct investment (FDI) inflows and the main obstacles in a region affected by economic and political instability. The study empirically analyses the economic, political and institutional determinants of FDI entry into the North African region from 2000 to 2017. Using the econometric technique GMM in panel data this paper shows two results: (i) the development of human, financial, commercial openness and the size of government are factors of attractiveness of FDI, this during inflation, public expenditure and the exchange rate negatively affects FDI. (ii) The improvement in the size of government reduces the negative effect of inflation on the attractiveness of FDI. These results call on the region's political authorities to improve the size of government, in order to attract more FDI.
Keywords: *FDI, Government size, Inflation, Dynamic panel data analysis*

JEL Classification: *F23, K2, E3, C23*

الملخص :

الهدف من هذه الدراسة تحديد المحددات الرئيسية لتدفقات الاستثمار الأجنبي المباشر والعقبات الرئيسية في منطقة متأثرة بعدم الاستقرار الاقتصادي والسياسي. تحلل الدراسة تجريبيا المحددات الاقتصادية والسياسية والمؤسسية لدخول الاستثمار الأجنبي المباشر إلى منطقة شمال أفريقيا من عام 2000 إلى عام 2017. وباستخدام تقنية الاقتصاد القياسي GMM في بيانات الفريق تظهر هذه الورقة نتيجتين : (1) التطور البشري والمالي ,الانفتاح التجاري وحجم الحكومة من عوامل جاذبية الاستثمار الأجنبي المباشر ، وذلك أثناء التضخم والإنفاق العام وسعر الصرف يؤثرا سلبًا على الاستثمار الأجنبي المباشر. (2) تحسين حجم الحكومة يقلل من التأثير السلبي للتضخم على جاذبية الاستثمار الأجنبي المباشر. تدعو هذه النتائج السلطات السياسية في المنطقة إلى تحسين حجم الحكومة من أجل جذب المزيد من الاستثمار الأجنبي المباشر.

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1. Introduction

Over the past two decades, FDI has emerged as a vector for the creation and transfer of wealth from one country to another through different transmission channels. For this reason, economists and global organizations consider the entry of FDI as a strategic instrument for development; it encourages countries to implement incentive policies that attract the most. Following the implementation of reform and liberalization programs in the late 1980 a remarkable observation of FDI inflows to poor and developing countries.

Each investor's objective is the search for a well-developed (human, financial, institutions) and stable business climate (macroeconomic stability, such as low inflation, exchange rates and politics, such as low corruption, respect for private property rights) in order to exploit the various opportunities and subsequently to increase profit. The presence of the combination of these factors, therefore, makes the objective of foreign investors clearer and more certain.

The entry of FDI depends on the macroeconomic stability of host countries. That is, low exchange rate volatility (Birgul and Sevcan, 2016 and Nabil and Sinan, 2019) and inflation rate (Braga de Macedo et al. 2009), are factors which explain the attractiveness of FDI, with the exception of other variables such as the unemployment rate, the level of economic growth and the interest rate. Financial development (Imen, 2018) of human capital (Korhan et al. 2018) and infrastructure (Boopen and Jameel, 2009) also the degree of commercial openness (Asongu et al. 2018) are factors of attractiveness of FDI.

The development of institutions also plays a very important role, including the attractiveness of FDI through political stability (Midjiyawa, 2015), the low degree of corruption (Asiedu, 2006) and respect for the private property rights of investors (Anyanwu, 2012). North (1990) defined the term institution as the set of informal constraints such as sanctions, taboos, customs, traditions and codes of conduct and formal rules such as constitutions, laws and private property rights.

On the basis of the previous academic research work it is possible to distinguish between two forms of FDI attractiveness; the real attractiveness as the development of infrastructures, human and financial capital, degree of political and economic stability and artificial attractiveness such as sitting subsidies and tax benefits, etc.
This paper is organized as follows: The first section presents a brief overview of the theoretical and empirical literature on the determinants of FDI inflows. The second section deals with the date, the econometric specification and the results obtained.1-Review of literature

1-1-Review of theoretical literature

The subject between FDI and its determinants has long been studied by the work of Itagaki (1981) and Cushmans (1985). The nature of the relationship between attractiveness factors and the entry of FDI remains a unclear subject. Asiedu (2006) and Gakpa (2016) checked the positive effect of macroeconomic stability on FDI inflow. Several economists have measured macroeconomic stability by exchange rate, interest rate and inflation. Others consider the control of public debt and the budget deficit and the unemployment rate are indicators of macroeconomic stability.
Jaratin et al. (2014), Birgul and Sevcan (2016) justified the existence of a significant correlation between the exchange rate and FDI inflows. FDI can determine the exchange rate or vice versa. In other words, the movement of FDI flows has an effect on the determination of the exchange rate. In this case, the entry or exit of FDI can also influence the appreciation or depreciation of the exchange rate because of the demand for the currency.
The link between exchange rate and FDI inflows has been studied for some time. Takagi and Shi (2011) concluded that the increase in exchange rate volatility favors FDI inflows. In other words, the exchange rate depreciation over a long period of time can attract the attention of foreign investors. That is, more exchange rate depreciation, plus FDI inflows. This relationship can be explained by the location of the exporting multinational firms on the national territory requires the depreciation of the currency of the host country to make them more competitive abroad. But the idea of exchange rate depreciation as an attractive FDI factor was ignored by Itagaki

(1981) and Cushmans (1985) which show that FDI export substitution can encourage foreign investors to invest more to escape exchange risk. This idea was criticized by Kiyota and Urata (2004) who show that FDI decreases when exchange rates are volatile.

The nature of the relationship between the exchange rate, FDI and external trade is explained by avoidance of transaction risks and high costs (due to exchange rate volatility) require multinational firms to reduce the volume of trade. This can make foreign investors very hesitant. On the other hand, lower expected import costs or increased expected usefulness of export earnings can increase exchange rate volatility. The increase in exchange rate volatility is a source of the increase in short-term transactions.

Institutional development plays an important role, including the attractiveness of FDI. Indeed, the good quality of the institutions that measures by the degree of corruption, the execution of contracts, the respect of private property rights, etc. reduces production and transaction costs. Reducing production and transaction costs can increase FDI profitability.

North (1990) has shown that the predictors of economic growth have incomplete information on real intentions. The latter can deceive others. In other words, the lack of information on the true intentions can return the FDI flows. The link between the developments of the institutions determines only by incomplete information on the true intentions, but it is determined by the protection of the private property rights of foreign investors, contract performance and economic freedom (Zghidi et al. 2016).

Anyanwu (2012) insisted on the rule of law guarantee and strict market regulation to save private property rights and improve the level of confidence of foreign investors. Mihaela et al. (2018) showed that the development of institutions under both indices (rule of law and corruption control) encourages the attractiveness of FDI for developed and developing countries despite the weak institutional structure in developing countries.

Natural resources are an explanatory factor for FDI. In this regard, Alaya (2004) showed that the availability of natural resources is an important factor, including the attractiveness of FDI. Generally, developing and poor countries have relatively more raw materials

(Gas, Oil, and Wood) than advanced countries. This factor encourages multinational companies to invest abroad to exploit their resources.

The exchange rate, the development of infrastructure and the availability of natural resources do not exclude the importance of infrastructure, including the attractiveness of FDI. In this regard, Boopen and Jameel (2009) justified the significant effect of infrastructure development on FDI inflows. In fact, infrastructure development reduces costs in order to maximize the benefit that represents the objective of all foreign investors. For example, the lack of infrastructure forces, foreign companies to build the roads themselves to bring the transfer of goods, which increases the cost of investment. Thus, the low cost of foreign direct investment and the operating costs that acquire through the development of basic infrastructure contribute to the increase in investment returns and thus stimulate the entry of FDI.

The development of human capital is undoubtedly a factor in the attractiveness of foreign investors. In this respect, the qualification of the labor force which plays a key element in human capital a very important role in the attractiveness of FDI. A well-developed workforce can easily adopt the new technologies incorporated by FDI. In this case, foreign investors hire local labor without training; this operation allows foreign investors to control costs.

Chien-Chiang and Chun-Ping (2009), Mamadou-Diang (2013) and Imen (2018) considered that financial development is a determinant of the attractiveness of FDI. We recall that financial development refers to the improvement of services related to the granting of bank loans, the anticipation and the forecast of risks related to the inflow of short-term capital flows, etc. Therefore, anticipating and forecasting risks allows the national authority to avoid crises and stabilize the economy. Also, the development of the financial sector in host countries makes it possible to transfer balances from one account to another, from paid at a distance without risk, etc. Facilitate the financing and execution of export and import operations of enterprises.

Dunning (1970), Barry (2013) and Mamadou-Diang (2013) justified the positive effect of the opening of trade on the attention of foreign investors. According to the latter, the relationship between trade

openness and FDI inflows may be explained by lower tariffs by lower trade taxes and the average more competitive foreign companies on the foreign market.

On the basis of theoretical research it can be seen that the choice of investments abroad depends on a set of conditions such as the exchange rate (Birgul and Sevcan, 2016), financial development (Imen , 2018), development of human capital (Silajdzic and Mehic, 2015) and institutions (Malikane and Chitambara, 2017), degree of commercial openness (Okada, 2013) and Diouf and Hai (2017), interest rate (Musyoka, 2018), inflation rate (Abdelmalki et al. 2012), etc.

1-2-Review of empirical literature

Historically, FDI inflows depend on exchange rate fluctuations. In other words, the depreciation or appreciation of the currency affects FDI policy. The existing literature presents contradictory problems between them, some studies supporting the positive and significant relationship while others reject.

Several empirical studies emphasized the link between the exchange rate and the entry of FDI. Birgul and Sevcan (2016) wanted to verify the relationship between the exchange rate and long-term FDI inflows in Turkey are using historical data from 2007 to 2015. The estimation of the RDAA model showed that there is a cointegration between the exchange rate level and FDI inflows.

Osinubi et al. (2009) examined the relationship between exchange rate volatility and the entry of FDI into Nigeria using secondary time series data from 1970 to 2004. The estimation of the error-corrected model by MCO showed that the exchange rate should not be a source of concern for the entry of FDI. The researchers justified the positive and significant relationship between the real exchange rate and FDI inflows. They show that the depreciation of the Naira increases the inflow of capital flows in the form of FDI.

Jaratin et al. (2014) analyzed the relationship between exchange rate fluctuation and FDI for Malaysia, the Philippines, Thailand and Singapore. They justified the cointegration between the two for all countries. The researchers announced that the exchange rate

fluctuation is negatively affecting FDI inflows for Malaysia, the Philippines and Singapore. The appreciation of the Philippine currency also has a positive effect on FDI inflows. The way causality between the exchange rate and FDI appears only for the Philippines and Singapore. And the long-term unidirectional causality extends from the exchange rate to the FDI appears in the case of Malaysia and the same for Singapore but in the short term.

Dharmendra et al. (2010) examined the effect of exchange rate uncertainty on the inflows of foreign investors into South Korea, Indonesia, China, Malaysia, the Philippines and Thailand. After checking the stationary nature and cointegration of the series, the researchers estimated the error-corrected model and showed that there is compatible with the theoretical predictions. That is, the exchange rate fluctuation positively affects the attractiveness of FDI capital flows for South Korea, Indonesia, China, Malaysia, the Philippines and Thailand.

Shari fi and Mirfatah (2012) identified the determinants of FDI in Iran over the period 1980- 2006. Thanks to the use of Johansan's econometric cointegration technique, the researchers showed that there is a direct relationship between the exchange rate, the opening of trade, the level of economic growth and the entry of FDI. They noted that exchange rate volatility and oil prices have an inverse relationship with FDI.

Musyoka (2018) focused on the connection between the exchange rate, inflation, real interest rate, economic competitiveness and FDI in Kenya from 1970 to 2016. Following the use of the ordinary least squares regression technique, the researchers showed that the real interest rate and the inflation rate have a negative and significant effect on the attractiveness of FDI. Also, the competitiveness of the economy has a positive and significant effect on the attractiveness of FDI capital flows in Kenya from 1970 to 2016.

Amadou (2018) identified the interaction effect between inflation volatility and governance on the attractiveness of foreign investors in a sample of 34 countries in sub-Saharan Africa from 1996 to 2014. The estimation of the FDI equation according to the other determinants by the first difference GMM method and in system showed that the volatility of the inflation rate has a negative effect on the attractiveness of FDI in the African region Improving the

quality of governance also reduces the negative effect of inflation on the attractiveness of FDI.

Komlan (2006) focused on the relationship between institutional development and FDI attractiveness in a sample of 40 countries in sub-Saharan Africa from 1989 to 2002. The differentiated GMM econometric technique justified the positive relationship between government capacities, good corruption, respect for the law and democracy and the entry of FDI.

Ines (2014) sought to identify the main determinants of the attractiveness of foreign direct investment in Tunisia. It shows that policies to regulate and strengthen good governance, strengthening macroeconomic stability and improving and developing infrastructure are the main policies for attracting foreign investors. It justifies the inverse relationship between inflation, availability of natural resources and FDI. The level of economic growth, trade opening, infrastructure and development loans to the private sector have a positive effect on FDI.

Bouri (2014) sought to identify the main determinants of FDI inflows to the MENA region from 1980 to 2011. The estimation of panel data shows that market size, trade openness, infrastructure development and political stability are the main determinants of FDI attractiveness.

Korhan et al. (2018) tested the relationship between FDI and the Human Development Index in Négéria over the period 1972 to 2013. Using the Johansan causality test, the researchers showed that there is a long-term relationship between the inflows of foreign direct investment and the enrollment rate, life expectancy. By using the Toda-Yamamoto test, researchers can identify the direction of causality. They justified the long-term two-way causality between FDI and life expectancy and the one-way causality between FDI and the rate of economic growth.

Following a cross-sectional time series analysis of data from 3 BRICS groups (Brazil, Russia, India, China and South Africa), MINT (Mexico, Indonesia, Nigeria and Turkey) and BRICS and MINT combined from 2001 to 2011, Simplice et al. (2018) argued that infrastructure development, trade openness and market size are the main determinants of FDI entry for BRICS and MINT. But the

role of the quality of institutions and the availability of natural resources is not significant in the attractiveness of FDI.

2-Data and empirical methodology

2-1-Data

Our study analyzes data from the four North African countries; Tunisia, Egypt, Algeria and Morocco over the period 2000 to 2017. We chose only the country area to have a continuous and complete database and to avoid the problem of missing values.

- FDI is defined as the net inflows of investments to acquire a sustainable management interest (10% or more of the voting shares) in an enterprise operating in an economy other than that of the investor. This is the sum of equity, profit reinvestment, other long-term capital and short- term capital as shown in the balance of payments. This series presents net inflows (new investment inflows minus disinvestment) in the reporting economy of foreign investors, and is divided by GDP. In our model, FDI refers to the dependent variable. This series is extracted from the World Bank database (2018). FDI-1 is the net inflow of foreign direct investment from the previous year compared to the current year. Other control variables are obtained from the World Development Indicators database (World Bank, 2018).
- Inflation: Generally, inflation negatively affects capital flows due to rising costs. On the basis of the previous work, inflation is measured by the general increase in consumer prices. The expected sign of the inflation coefficient is negative.
- Financial Development: In our study, we measure financial development by the value of credit provided by the banking sector as a percentage of GDP. The credit index provided by the banking sector measures the degree of intimidation of the banking system in the overall activity of the economy. This indicator includes credit to the private and public sector. The expected sign of financial development is positive.
- Public expenditure: In our research, we measure public expenditure by the value of government final consumption

expenditure which included all current government expenditure on goods and services. It also includes most national defense and security expenditures, but excludes government, military expenditures as part of the government capital formation. The expected sign in the coefficient of public expenditure is negative.

- Human capital: On the basis of previous work, human capital can be measured by the primary, secondary or university enrolment rate, the number of branches in higher education, the demographic rate, research and development, life expectancy, HDI, etc. Generally, human capital development attracts foreign investors. Due to the lack of a database of secondary and university enrollment rates, the full HDI series for all countries in our study, we used the primary enrolment rate as a proxy for human capital.
- Size of government: To show the role of the size of governance, including the attractiveness of foreign investors, we use the legal system and property right sub- index. This indicator includes the following sub-indices: judicial independence, impartiality of the courts, protection of property rights, military interference in the political process, the integrity of the legal system, compliance with contracts, regulatory costs of selling real property, police reliability, and crime costs for business. The database for this indicator was obtained from Fraser Institute (2018).
- Exchange rate: The real effective exchange rate is a measure of the value of a currency relative to the weighted average of several foreign currencies divided by a price deflator or cost index. The expected associated sign at the exchange rate is negative.
- Commercial opening rate: The opening of the economy to the outside world is one step in the process of financial integration. It refers to the stage of liberalization of the real external sector. This step facilitates the processes for integrating an economy internationally. In my thesis, we measure the trade openness of the economy by the ratio of total exports plus imports to GDP. This series is taken from

the World Bank database (2018).

2-2-Empirical methodology

To identify key determinants and barriers and highlight the impact of government size on FDI attractiveness in the North African region, we value the riding that defines the EDI according to its main determinants that inspired the work of Okada (2013). This relationship is summed up by the following equation:

$$FDI_{it} = \alpha_0 + \alpha_1 FDI_{it-1} + \alpha_2 HK + \alpha_3 FD_{it} + \alpha_4 PE_{it} + \alpha_5 INF_{it} + \alpha_6 ZG_{it} + \alpha_7 EXR_{it} + \alpha_8 COP_{it} + \varepsilon_{it}$$

with:

$$\varepsilon_{it} = \gamma_i + \mu_t + \theta_{it}$$

where

γ_i : The heterogeneity factor of countries which takes into account all the unobserved factors, constant over time.

μ_t : The specific effect in the time dimension.

θ_{it} : Refers to the term error that takes into account unobserved factors that vary over time.

$t = 2000 \ldots\ldots\ldots\ldots 2017$

and

$i = 1,2,3,4$

The identification of the role of the government whose

attractiveness of FDI by controlling the rate of inflation

requires the estimation of the following equation:

$$FDI_{it} = \alpha_0 + \alpha_1 FDI_{it-1} + \alpha_2 HK + \alpha_3 FD_{it} + \alpha_4 PE_{it} + \alpha_5 INF_{it} + \alpha_6 ZG_{it} + \alpha_7 EXR_{it} + \alpha_8 COP_{it} + \alpha_9 (ZG_{it} * INF_{it}) + \varepsilon_{it}$$

2-2-1-Unit root test

The application of unit root tests on panel data is a recent phenomenon born by Levin and Lin (1992), Im, Pesaran and Shin (1997), Levin and Lin (1993), Wu (1999) and Levin, Lin and Chu (2002). In our research we are interested only for the tests of Im, Pesaran and Shin. The null hypothesis of Im, Pesaran and Shin (2003) is based on the notion of independence between the panel

units. The table below summarizes the unit root test of the different series. The table below shows the stationary nature of the variables.

Table 1: Stationary Variables

	Level							
variable	**FDI**	**HK**	**FD**	**PE**	**INF**	**ZG**	**COP**	**EXR**
	-0.64728 (0.258) ns	0.11719 (0,572)	0.12579 (0.550) ns	1.31726 (0.906) ns	-2.19892 (0.013)**	0.96339 (0.832) ns	0.17580 (0.569) ns	0.18180 (0.546) ns
	1st difference							
Variable	-3.00280 (0.001)***	-0.22391 (0.411) ns	-1.30304 (0.096)*	-0.04350 (0.482) ns	-4.2117 (0.000)***	-0.15368 (0.438) ns	-4.30099 (0.000)***	-1.36268 (0.086)*
	2nd difference							
Variable	-4.64739 (0.000)***	-3.38575 (0.000)***	-5.29284 (0.000)***	-3.08645 (0.001)***	-5.54672 (0.000)***	-2.64467 (0.004)***	-6.89898 (0.000)***	-3.31045 (0.000)***

***, **, * significant at the threshold of1%, 5%, and 10%. Values in brackets are probabilities

According to the table above, the null hypothesis of a unit root at the level of all variables is not rejected except for inflation. In other words, FDI, human capital, financial development, public expenditure, government size, trade openness and exchange rates are not fixed at the level. Inflation is flat and flat. When we turn to the 1st difference we notice that FDI, financial development, inflation and exchange rate are stationary. However, human capital, public spending and the size of government are not static. When we go to the second difference we find that all the series of variables become stationary.

2-2-2-Correlation test

The type of non diagonal variance-covariance matrix indicates the presence of a self- correlation problem and vice versa. The purpose of the multi-colinearity test is to verify the presence of a correlation between the model variables. . In fact, the good regression model does not hold a correlation between the different variables. In our model if FDI, FDI-1, human capital, inflation, public spending, exchange rate, trade openness and government size are correlated so they are not orthogonal. Multi-colinearity is defined as if the coefficient of correlation between variables is greater than 0.9^3. The following table summarizes the correlation coefficients between the different variables in the model.

Table 2: Correlation Matrix

	EXR	**PE**	**FD**	**FDI**	**INF**	**HK**	**COP**	**FDI-1**	
EXR	1								
PE	0.0502	1							
FD	0.1573	0.0048	1						
FDI	-0.2859	0.0804	0.0490	1					
INF	-0.0779	0.4983	-0.0399	0.0308	1				
HK	0.4461	0.2812	-0.8054	0.1000	-0.0364	1			
COP	0.4315	-0.2895	0.5157	0.1978	0.0423	-0.0535	1		
FDI-1	-0.3766	-0.1135	0.0093	0.6177	0.0643	0.1522	0.2107	1	
ZG	0.0842	0.4281	0.4431	0.0804	-0.3154	-0.2101	0.5377	0.0040	1

According to the table above, the correlation coefficient between the variables does not exceed the coefficient of Ghozali (2013). So, we're talking it's not a problem of multi- colinearity between the different variables. The correlation between variables can be explained as follows:

In our search the FDI is positively correlated with all variables except the exchange rate. The coefficient between the two is equal

to -0.285. The most correlated variable with FDI is the delayed variable of a coefficient of 0.617. The correlation coefficients between FDI and government spending, financial development, human capital, trade openness and government size are 0.080, 0.049, 0.1, 0.197, and 0.080 respectively. The month variable correlates positively with FDI inflows in the North African region from 2000 to 2017 is inflation. The correlation coefficient between the two is equal to 0.030.

From 2000 to 2017 the exchange rate is positively correlated with all variables except the delayed variable and inflation. Indeed, -0.376 and -0.077 are the exchange rate correlation coefficients with FDI-1 and inflation. The most correlated variable with the exchange rate is human capital with a coefficient of 0.446. Public expenditure, financial development, trade openness and government size are correlated with FDI by a coefficient of 0.050, 0157, 0.431 and 0.084 respectively.

From 2000 to 2017, inflation and the size of government are the most correlated with government spending. The correlation coefficients are therefore 0.498 and 0.428. -0.113 and -0.289 are the correlation coefficients of public expenditure with commercial opening and the delayed variable. The correlation coefficients between human capital, financial development and public expenditure are 0.281 and 0.004 respectively.

-0.039 and -0.805 are the correlation coefficients of financial development with inflation and human capital respectively. The variable most correlated with financial development is the commercial opening of a coefficient of 0.515. Financial development is positively correlated with the size of government and the delayed variance of 0.443 and 0.009 respectively.

Inflation is negatively correlated with human capital and government size. The correlation coefficients are therefore -0.034 and -0.315 respectively. The overall increase in consumer prices from 2000 to 2017 in the North African region is positively correlated by 0.0423 and 0.0643 with the trade opening and the delayed variable.

-0.210 and -0.05 are the correlation coefficients of human capital with government size and trade openness. 0.152 is the correlation coefficient between human capital and the delayed variable. From

2000 to 2017 the trade opening is positively correlated with the size of government and the delayed variable. The correlation coefficients of trade openness with government size, the delayed variable are 0.5377 and 0.2107 respectively. 0.004 is the correlation coefficient between government size and the delayed variable.

2-3-Empirical result

2-3-1- Model estimation

After presenting the unit root test and correlation matrix, the objective in this paragraph is to present the specification procedure of the studied model as well as the results of the various tests of this specification. The tests are concerned:

- **Homogeneity Test**

It is said that the data for a variable are homogeneous with respect to individuals if the characteristics (particularly mean and standard deviation) of this variable are the same regardless of i. The hypothesis we want to test is this:

H0: There are no individual effects in the data

H1: There are individual effects in the data

The statistic resulting from this test is that of Fisher with (N-1, NT-N-K-1) degrees of freedom. Homogeneity test results will be presented to detect if there is an individual effect in the model. This is a test of Fischer and Khi-Deux, if the calculated value of the statistic is higher than the tabulated value (where the associated probability is less than 0.05) the null hypothesis of homogeneity is rejected and it is concluded that αi are different.

In our case, it is clear from the previous table that we will reject the hypothesis of homogeneity, so it remains to be seen whether this individual effect detected is deterministic (fixed) or random. We will therefore apply the Hausman for the answer to that question.

Table 3: Homogeneity Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	9.078	6.491	0.004
Cross-section Chi-square	39.124	7	0.000

- **Hausman Test**

When dealing with individual effect models, the first question to ask is how these individual effects should be specified. Should we adopt the hypothesis of fixed effects or, on the contrary, that of random effects? The Hausman test will allow us to answer these questions by testing the following hypotheses.

H0: Individual effects are random or (E(εi/X) =0)

H1: Individual effects are fixed (E(εi/X) 0)

Table 4: Hausman test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	62.98	7	0.000

The chi2 statistic displays a value of 62.98 with a p-value of 0.0000. It is concluded that individual effects will be represented by fixed effects.

- **Estimation**

After processing the data on Eviews 9 the following results are obtained. The table below shows the result of the GMM estimate as a difference.

Table 5: Determinants of the FDI

Variable	*without interaction*	*with interaction*
Constant	0.121 (0.047) **	0.136 (0.015) **
Financial development	0.168 (0.008)***	0.171 (0.006)***
Public expenses	-0.084 (0.032)**	-0.057 (0.011)**
Inflation	-0.003 (0.095)*	0.001 (0.042)**
Human capital	0.620 (0.014) **	0.679 (0.002) ***
Exchange rate	-0.421 (0.066)*	-0.409 (0.055)*
Commercial opening	0.312 (0.004) ***	0.370 (0.010) ***
foreign direct investment from the previous year	0.056 (0.000) ***	0.076 (0.000) ***
Size of government	0.308 (0.036) **	0.509 (0.019) **
Size of government * Inflation	-	0.047 (0.046) **
R-Squared	0.401	0.470
R(2)	0.324	0.369
F	1.68	1.93

***, **, * significant at the threshold of1%, 5% and 10%. The values in parentheses are the probabilities.

2-3-2-Interpretation of result

According to the table above, the size of government in the North African region under the index of the legal system and private property rights positively affects the entry of FDI. Indeed, the sign associated with the size of government is positive and statistically significant at the 5% threshold. From an economic point of view, this relationship is explained by the region of North Africa from 2000 to 2017 characterized by an independent judicial system that protects the private property rights of investors; comply with contracts also with the low costs of crime.

The general increase in consumer prices from 2000 to 2017 in the North African region has a negative and significant effect on FDI. This relationship can be explained by the general increase in prices (mainly raw materials, labor costs) making foreign exporters less competitive. Our finding is consistent with previous studies by Amadou (2018) and Musyoka (2018).

In order to identify the size of the contribution of government to the decrease of the negative effect on the attractiveness of foreign investors, we estimate in the second step the interaction effect between the size of government and inflation on the IDE. The results are; the interaction index has a positive and significant effect at the 5% threshold, the effect of the size of government increased from 0.308 to 0.509. The inflation rate is also positive and significant at the 5% threshold. This relationship is explained by good governance in the North African region from 2000 to 2017 contributes to the attractiveness of FDI directly through the guarantee of private property rights of foreign investors and compliance with contracts and indirectly by controlling consumer prices.

Lending in the banking sector from 2000 to 2017 in the North African region attracts foreign investors. In our research the sign associated with the variable financial development is positive and statistically significant at the 1% threshold before and after the interaction. Our result is corroborated by the study by Imen (2018).

The positive effect of trade opening on the attractiveness of FDI is justified in both cases. Indeed, before the interaction the sign linked to the variable commercial opening is positive and significant at the

1% threshold. After the interaction the effect of the commercial opening becomes more important. It increases from 0.312 to 0.370. Our result contradicts the study of Canh Phuc et al. (2018). This relationship is explained by the removal of external trade barriers in the region in the late 2000s. This policy can therefore attract foreign investors with an export aim.

From 2000 to 2017 the most attractive factor of FDI in the North African region is human capital. The latter has a positive and significant effect on the threshold and 5% and 1% after the interaction. The relationship between human capital and FDI entry is explained by the most skilled and well-developed workforce adopting easily with the new technologies incorporated into FDI. This makes investment costs cheaper.

The sign associated with the public expenditure variable is negative and statistically significant at the 5% threshold in both cases. That is to say, public spending in the North African region has a negative effect on the attention of foreign investors. This may be explained by foreign investors as the poor quality of infrastructure in the North African region is due to the low value of infrastructure spending.

In both cases the delayed variable has a positive and significant effect on foreign direct investment inflows at the 1% threshold. Our result corroborates the previous study by Amadou (2018).

The exchange rate has a negative and statistically significant effect on FDI at the 10% level in both cases. After the interaction, the effect of the exchange rate on FDI declined from -0.421 to -0.409. This relationship is explained by the depreciation of the Tunisian and Libyan Dinar and the Egyptian pound against the euro since the revolution which can increase the investment costs. Our results corroborate the study by Jaratin et al. (2014).

Conclusions and policy implications

Our study identifies the main determinants and barriers of FDI inflows in the North African region. The use of econometric estimation technique GMM first difference on panel data from 4 countries (Tunisia, Algeria, Morocco and Egypt) from 2000 to 2017 justifies the positive and significant effect of government size under the Legal System and Property Rights Index, commercial openness, financial and human capital development.

However, the general increase in consumer prices, the exchange rate and public expenditure have negative and significant effects on FDI. We examine the role of government size as an indirect determinant of FDI through inflation control. The interaction variance between the two positively affects the FDI input. After the interaction, the effect of inflation becomes positive and significant also the effect of the size of government on the entry of FDI has increased. Our results urge the region's officials to urgently improve the size of government in order to control inflation to attract more FDI.

The results have clear policy implications, namely both economic growth and reform are important in attracting FDI. North African governments take steps to diversify their economies in order to reduce susceptibility to macroeconomic shocks and provide a better environment for investors.

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