Multidimensional Determinants of foreign Direct Investment in Central Africa: A Modified Gravity GMM Panel Approach

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Abstract

This research's objective is to highlight the multidimensional determinants of FDI in Central Africa countries, especially in the Economic and Monetary Community of Central Africa (EMCCA). To do this, a modified and adapted gravity model is constructed and tested by the GMM method. The main result shows that natural resources are by far the most significant determinant of FDI in the EMCCA. Market size (population and gross domestic product) may also play a role in attracting FDI in addition to natural resources and infrastructure. However, we find that economic openness remains to be perfect to attract foreign investors.

Key words: Determinants; Specific advantage; FDI; Gravity model; natural resources;

1. Introduction

The reasons why multinational companies (MNCs) locate in Central Africa than elsewhere are difficult to understand. Dunning (2001) argued that firms must locate where the "specific advantages" of a country maximize the benefits of the firm. In light of the case of other developing countries that Dunning thought, the question that arises is whether these reasons are the same in the EMCCA. What are the determinants of FDI in Central Africa? Are these determinants the same as elsewhere? Is there a specific instruction to draw FDI to Central Africa? We try to answer these various questions in this research.

The scientific basis of FDI has been built from three major schools of thought: the traditionalist, the modernist and the integrationists. The greatest contribution of the traditionalists to FDI comes from its attention to the impact of FDI in developing countries (DCs) and its critics to the OLI paradigm that looks at FDI as essentially positive. On the other hand, the contributions of modernist (Mundell (1957), Hymer and Kindgleberger (1950-1960)…, and the structuralists have been widely criticized that all these theories are not verifiable.

The image of Africa and particularly in Central Africa as a host area for FDI has not always been favorable. Often, Africa has been presented through its problems of famine, economic chaos, and political instability. However, Central Africa is the area in Africa that has achieved the highest average growth rate of GDP over the past ten years. The discovery and the beginning of oil production in Chad and Equatorial Guinea (two countries that were among the poorest in the world), and the rising price of a barrel of oil, opened new perspectives to these countries. However, the renewed growth seen over the last ten years after the two oil crises of the 1980s with disastrous consequences has been possible without the important contribution of foreign investors. Indeed, Chad's oil investment required several times the budget of this country, as well as that of Equatorial Guinea. At the same time, surveys undertaken in the former oil-producing countries such as Congo and Gabon led to discovery of a major marine deposit in the Congo, and operation of a new well in Gabon. All these achievements wouldn't have been possible without the FDI in the hydrocarbons sector.

Determinants of FDI in developing countries are increasingly the subject of numerous studies. Authors such as Assiedu (2001), Stiglitz (2002), Dupuch (2004), mold (2004), and especially Dunning (2001) have contributed, but little or no study was conducted in Central Africa.

Is the abundance of natural resources in itself sufficient to attract FDI in the EMCCA? 75% of EMCCA countries are part of the least developed countries; it is necessary to check whether there is a particular form of FDI going to that

area. It's also necessary to know if corruption (often indexed in developing countries as a brake on FDI inflows), much maligned in the CEMAC represents an obstacle to the attractiveness of FDI.

2. Review of the Literature

There is extensive literature on the determinants of FDI in developing countries. We first examine the results of some investigations that have been carried out. We then examine the literature on institutional factors (good governance, political stability and corruption) and economic factors (market size, fiscal and monetary policy, natural resources, etc.).

2.1 The investigation of the determinants of FDI

In the years 1990, the Foreign Investment Advisory Service conducted a survey of hundreds of large multinationals in the Triad to try to identify the most important components in terms of FDI attractiveness. The results show that the political and economic stability at the top part of the conditions precedent to foreign direct investment in the area.

Studies by AT Kearney with the leaders of very large global companies are in turn that five factors have the most influence on the choice of investment location: the market size, political stability and macroeconomic growth, the regulatory environment, the ability to repatriate profits (Business Development, 1999).

The first survey covers 10,000 companies in 80 countries. The sample of African countries south of the Sahara (PASS) covers 413 companies in 16 countries including countries of the EMCCA (Cameroon). The companies concerned must give the 4 points which they say are forcing the business environment (1 = no stress to severe stress = 4). The second survey was conducted in 1996 and 1997 and covered 3,600 firms in 63 countries. The sample included 540 PASS for firms in 22 countries with two CEMAC countries (Chad and Cameroon). The same question was posed to stakeholders, but this time the notes ranged from 1 to 6 (1 = no stress to severe stress = 6). The third survey conducted in 1999/2000 covered 63 major multinational companies selected on a database of 100 largest multinationals, respondents were given the factors that had a negative impact on FDI in PASS. The last survey, covering 81 multinationals in the countries of the South Africa Development Community (SADC) and they were asked to provide the main sources of risks to FDI in this part of Africa. According to Assiedu the result of this survey shows that corruption is by far the biggest obstacle for FDI, followed by the laws and regulations on FDI, poor infrastructure, macroeconomic instability (which includes inflation and devaluation) and political instability.

2.2 Institutional Determinants of FDI in empirical models

In general, there is some consensus about the role of institutions on the attractiveness of FDI in developing countries. The literature highlights some predominant aspects: the quality of institutions, the investment climate (reforms), corruption, political risk, and good governance.

Lucas (1993) thinks that political instability is a concern of foreign investors in developing countries. This instability is often manifested by the confiscation of property, dislocation of production structures, the change in macroeconomic management and especially the regulatory environment. McMillan (1995) believes instead that the stability of institutions may not have the expected positive effect, because even if the security of the investment is insured, it can have an effect as strong as that created by market forces. In the same vein, Wang and Swain (1997) find a negative correlation between FDI flows and political instability of multinational corporations and their subsidiaries: political instability, corruption, non-institutional transparency, payment or modification of sovereign debt, wars and coups are other situations that affect the business environment and therefore reduce the inflow of FDI. These changes may affect operating profits as the value of capital. Thus, country risk is multidimensional and pervasive in all international economic transactions.

Wilhelms (1998) analyzes the determinants of inward FDI in emerging economies between 1978 and 1995. For this, it uses an innovative concept called "institutional fitness" which is rooted in the theory of FDI and integrationist states that FDI is mainly determined by the institutional variables that may change in policy, laws and their applications. To test the concept, it uses an econometric model panel. The result obtained shows that the variable "government" and "market" are the most significant determinants of FDI inflows. It is clear from his analysis that when investors are willing to negotiate, they seek stability and transparency through just laws with respect to privileges.

Globerman and Shapiro (1999) abound in the same line and show that good institutions may have similar effects on the outward and inward FDI to the extent that they create an environment conducive to multinationals abroad. These authors deepen their idea in 2002 in a study on the impact of governance on FDI inflows from the United States to

developing countries using a probit model OLS. They find that national political infrastructure, measured by the six governance indicators estimated by Kaufmann, Kraay and Zoido-Lobaton (1999), is a determining factor for the output of U.S. FDI to countries with economies in transition.

The work of J. Morisset and O. Lumenga Neso (2002) lean instead on corruption and poor governance. The authors argue that corruption increases the administrative costs and thus discourage the entry of FDI. Other studies confirm the robustness of the political and institutional factors as important determinants of the location of FDI to developing countries [and Daude Stein (2001)] or in Latin America [Stevens (2000)].

Some empirical studies focus on the investment climate as a determinant of FDI. Econometric work in panel data with fixed effects led by K. Sekkat and M. Véganzonès-Varoudakis (2004) on a sample of 72 developing countries during the 1990s, show that reforms that focus on trade liberalization and exchange rate coefficient expressed by the Sachs-Warner and the investment climate (political and economic) are the determinants of the attractiveness of FDI. According to their findings, some countries in the MENA region (Algeria, Syria, Egypt and Iran) suffer from a lack of attractiveness related mainly to the delay of reforms and the deficiency of the political and economic conditions.

Some authors focus on country risk in the location decision of MNCs in developing countries. Thus, Hassan and Zlata (2001) attempt to explain the uneven distribution of FDI in developing countries by the country risk. Michalet (1997) argues in turn that when the legal and regulatory environment is constantly being changed arbitrarily, and there is no court that can ensure compliance, companies are forced to limit or even suspend their financial commitments.

Benassy-Quéré, Coupet and Mayer (2007) attempt to assess econometrically the role of institutional quality in a set of 52 countries on FDI in both origin and host countries to include an institutional variable. They build a panel gravity model and the results obtained show that the institutions of the host country influence the FDI with or without the inclusion of GDP per capita in the model.

2.3 Determinants of FDI in economic empirical models

For Aisenman (1992), if an MNC has a flexible production structure, the volatility of exchange rates can result in a shift from the production of its activities. As against it has little effect on the location of FDI when the production structure is rigid. The decision of FMN risk aversion in their location abroad depends on their anticipation of future changes in the real exchange rate.

The study by Darby et al. (1999) emphasizes the value of the waiting option, stress of uncertainty and "sunk costs". In the same vein, Cushman (1988) estimated that occur in the destination market for exports is an alternative if there is strong uncertainty about exchange rates. After all, if Cushman found that the theoretical effects of the volatility of the exchange rate are ambiguous, in fact, he finds a positive impact on the volatility of exchange rates on outward FDI.

Urata and Kawai (2000) believe that inflation increases the cost of production and hence it has a negative impact on FDI flows, this is confirmed by Schneider and Frey (1985), Yung et al. (2000) and Urata and Kawai (2000) and Ngouhouo (2005) for which inflation is generally used as a measure of domestic economic stability. For this author, a high inflation rate reflects macroeconomic instability, which increases uncertainty and makes it less attractive to FDI.

Several studies have used econometric models to explain gravity type of FDI (eg Walid and Safarian (1963), Egger and Pfafermayr (1998), Anderson (2004) etc...), to identify the main determinants of FDI and make the empirical validation to competing models.

Thus, Grosse and Trevino (1996) analyzed in the context of a gravity model determinants of FDI flows entering the U.S. from 23 countries on a bilateral basis, for the period 1980-1992. Their results using OLS indicate that the main sources of positive influence on inward FDI are exports and market size of country of origin of FDI, while the main sources of negative influence are the cultural differences between these countries and the United States, the geographical distance and the exchange rate.

Wang and Swain (1997), Mallampally and Sauvant (1999), Basile (2004) and Kruger (2004) believe that the market size is the first element of the investment strategy abroad. For these authors, market growth is an indicator of development potential.

In the same vein, a study on a group of 29 African countries for the period 1996 to 1997 highlights the importance of local market size on FDI inflows. A positive correlation is made between direct investment and GDP (equal to 0.99) is established (Morisset, 2000).

The ability of African countries to attract private capital is largely determined by the existence of natural resources (Morisset, 2000). Thus countries like Nigeria and Angola and to a lesser extent Equatorial Guinea, despite their political and economic instability, have managed to attract much private capital due to their oil resources.

Krugel (1997) uses the number of telephone lines per 1000 inhabitants as proxy variable of infrastructure, and built a panel model on a set of 17 countries in sub-Saharan Africa. The author finds that infrastructure promotes the entry of FDI, which in turn increase the productivity of multinational firms. He also found that in these countries, the infrastructure remains a bottleneck for the entry of FDI.

Given the empirical review of the literature, we find that most of the work agrees that the determinants of FDI depend on the country or economic area home. These studies also show that certain factors are often significant (market size, institutions, natural resources etc...), While others are less so (distance, monetary variables, etc.). These studies also fish on several issues including poor specification of the model (gravitational model without countries of origin's effects as Walid (1963) and Mafizur (2006)). Still others estimate without specification tests to select the appropriate model. This results in the presence of multicollinearity and the existence of selection bias in the model.

Our job is to use the gravity model analyzed by the GMM method in a dynamic panel which we believe is sufficiently robust to tackle econometric deficiencies raised.

3. Econometric Model

3.1 A Gravity Equation

The gravity model that we will remember is an enriched form from that of Anderson and Matyas (1996, 1997, and 1998) and Melo et al. (2005). In fact, instead of the flow of goods that are exchanged between two countries or between two blocks, or even trade within a country between two or more regions, we consider here FDI flows to range from a block of selected countries which we call investors countries (PI) to another group of countries (the countries of the EMCCA) which we call the PC. The EMCCA countries under study are five in number and are the host country for FDI from PI.

Apart from FDI made in the model instead of imports, we used as recommended by the gravity model, incomes of PI and PC, which will be given here by the gross domestic product (GDP) of the group of PI and of each PC used here as a proxy for market size; the variable distance between the IP and host countries (Dij) and populations variables of Ni and Nj of PI and PC.

$$IDE_{ijt} = \beta_o \; N_{it}^{\beta_1} N_{jt}^{\beta_2} Y_i^{\beta_3} Y_j^{\beta_4} D^{\beta_5}{}_{ij} \mu_{ijt} \qquad (4)$$

Dijt = Distance between country i and country j, IDEij = FDI flows from PIs to the PC; Ni and Nj represent respectively the population of the group of PI and PC; β_o constant; $\beta_1, \beta_{2,} \beta_3, \beta_4, \beta_5$ = parameters; μ_{ijt} is the error term.

Thus, after linearization in logarithmic form we obtain the following initial model:

$$Ln(IDE_{ij}) = \beta_o + \beta_1 Ln(N_{it}) + \beta_2 Ln(N_{jt}) + \beta_3 Ln(Y_i) + \beta_4 Ln(Y_j) + \beta_5 Ln(Dij) + \mu_{ijt} \qquad (5)$$

Our model is enriched by some financial variables, economic, institutional, such as the inflation rate (INF), the exchange rate (TC), the rate of opening (OPEN), the interest rate (INT) natural resources by taking proxy major export products of each of the countries of the CEMAC (RN), country risk (PR), the number of telephone lines per thousand capita as a proxy of infrastructure (TEL). Hence the equation 6 below:

$$\begin{aligned} Ln(IDE_{ijt}) &= \beta_o + \beta_1 Ln(IDE_{ijt}(-1)) + Ln\beta_2(N_{it}) + \beta_3 Ln(N_{jt}) + \beta_4 Ln(DIS) + \\ &\beta_5 Ln(INF) + \beta_6 Ln(TC) + \beta_7 Ln(ouv(-1)) + \beta_8 Ln(RN) + \beta_9 Ln(RP) + \\ &\beta_{10} Ln(INT) + \beta_{11} DUM + \beta_{12} Ln(TEL) + \beta_{13} Ln(Y_i) + \beta_{14} Ln(Y_j) + \gamma_i + \vartheta_j + \mu_{ijt} \end{aligned} \qquad (6)$$

γ_i represents the origin country effect (PI), ; ϑ_j the FDI's effect of host country (PC), μ_{it} the error term; i = 1, j = 1, ..., T-1; T = 1, ..., N; J = 1 with the additional countries represented by the PI (Group of investors in the EMCCA). As we have already defined above in the gravity model chosen, i represent the country of origin also known as (PI), j host countries (PC) and t is time. Equation (6) represents the model to be estimated in a dynamic panel GMM.

3.2 Variables

We consider three types of variables: the dependent variables, the explanatory variables and instrumental variables. Instrumental variables will be selected in the econometric tests and will be the one year lagged values for explanatory variables, two years for the lagged dependent variable. It is generally accepted in the literature that the lagged values are good instruments for the explanatory variables.

3.2.1 - The dependent variables: the dependent variable is: Ln (IDEijt). In general, the variables are in logarithm. One advantage of estimating the relationship is logarithmic in the parameters which can be interpreted as elasticities. The index i indicates the group of industrialized countries (PI). They consist of the main countries that make direct investments in the countries of the CEMAC. In order of importance include the United States, France, China, the United Kingdom, Italy, Germany, Belgium, Switzerland, Malaysia, Benelux ... and the index j the group of CEMAC (PC). The index t indicates the time or year. The amounts are expressed in dollars or in millions of current dollars (USD) for each year t.

3.2.2 - The explanatory variablesDistance; Ln (Dij): when the model is applied to the flow of goods, the distance is generally regarded as an approximate measure of transportation costs. This interpretation, however, is more defensible in the case of capital movements. Also the role of distance is it attributed to transaction costs and information that a company suffers when investing abroad (Portes and Rey, 2000). The distance generally used for the estimation is the distance as the crow flies. Most Central African countries have trade with European countries, which is why we took the center of Europe as the distance of access to industrial countries (PI). The PI (including China and Malaysia) are considered a group as whole and not individual countries. So this is a distance from a center taken as a proxy Capital Group (Brussels) to the different capitals of the CEMAC that are Yaoundé for Cameroon, Libreville for Gabon, N'Djamena for Chad, Brazzaville for Congo and Malabo for Equatorial Guinea. Most studies based on the gravity model shows that distance plays a negative role on trade and for this reason; we expect a negative sign between FDI and distance.

Infrastructure: Ln (LTE); the level of infrastructure can provide an environment conducive to the entry of foreign investment. In the absence of statistical data, we take as proxy variable the number of telephone facilities per 1000 population in each of the CEMAC countries. The infrastructure of the area will mean the aggregate of the five countries under study. We expect a positive relationship between infrastructure and FDI.

Gross domestic product: Ln ((Yi and Yj)); the GDP is a measure of the extent of the market: the higher this variable is, the higher the market size is able to attract FDI. In the literature, this variable was very relevant in developed countries and less so in developing countries. We test whether FDI is directly related to these two variables in the CEMAC.

Natural resources: Ln (RNAT); natural resources here represent the sum of the principal exports (exports + agricultural exports of mining and oil + other exports) of each of the CEMAC countries such as cotton and oil in Chad, cocoa, coffee, oil, timber, bauxite, plantain in Cameroon, timber, manganese and oil in Gabon, wood and oil for the Congo, oil and cocoa and coffee for Equatorial Guinea. Given the weight of natural resources including oil in the economy of the CEMAC, we expect a positive relationship between FDI and natural resources.

Population: Ln ((Ni and Nj)); the population as income is a measure of market size and generally, a country with a high population attracts more FDI than a country low inhabited. It can be seen in Africa as in the rest of the world, countries with large populations are also more attractive. We test if there is a positive influence of population on FDI in the EMCCA.

Openness: Ln (OPEN); the openness of an economy is measured by the ratio of trade to GDP (exports plus imports divided by GDP). It measures the importance of trade (Wilhems, 1998) and more indirect trade restrictions. This ratio can be an attractive for FDI. We expect a positive sign between economic openness and FDI.

Inflation: Ln (INF); The growth rate of consumer price is a factor that appears to be closely involved in situations of excess liquidity. In the empirical literature, a high rate of inflation often leads to a negative relationship with FDI and vice versa for a low rate. Given the difficulties that most CEMAC countries are in compliance with the convergence criteria for inflation, we expect a negative sign between FDI and inflation.

The interest rate: Ln (INT); the interest rate measures the borrowing capacity of local resources by foreign investors. The lower it is, the more favorable to FDI inflows. The dimension of the relationship between interest rate changes and FDI, however, according to the regime where we are. As part of the CEMAC (area where the interest rate is often referred to as partial liability), we are unsure of the significance of the relationship and the expected sign.

The exchange rate: Ln (TCH); the exchange rate affects FDI through "exchange distortion", and its instability described by the "volatility of exchange. Two theoretical arguments can be advanced to explain this relationship: the flexibility of production and risk aversion. A high exchange rate in the host country pushes investors to invest more in the context of

repatriation of more profit if the production is sold inside. But this advantage can become harmful if the production is directed towards exports. We are undecided about the expected sign between FDI and exchange rates.
Country risk: Ln (RP); the indicators that seem most appropriate and which we retain in our econometric model is the data of the International Country Risk Guide (ICRG). The ICRG was created to predict the economic, financial and political risk in 1980 by the editors of International Reports, "Political Risk Services." The evaluation of the International Country Risk Guide (ICRG) is based on 22 variables divided into three subcategories of risk: political risk, financial risk and economic risk. The expected sign of the relationship between this variable and FDI is negative.
Debt levels: DUM; a dummy variable is considered to represent the level of debt: it is set to 1 for periods of low debt countries in the EMCCA (1960-1985) and 0 otherwise. We expect a negative sign of the relationship that this variable can have the IDE.

3.3 Statistical data

Like any empirical study based on developing countries, it is very difficult to collect statistics. Thus, countries such as Equatorial Guinea and Gabon do not have a statistically reliable service; we relied on the services of the Central Bank of EMCCA and especially on the website of the Division of Statistics of the United Nations.

The data collected from these two sources for the period 1970-2005 are: foreign direct investment to the CEMAC between 1970 and 2005, GDP or Yjt and Yit noted respectively for PI and PC in the same period; populations Ni and Nj of PI and PC infrastructure (with proxy for the number of telephone lines per 1000 inhabitants (LTE)), changes in consumer prices or inflation rates. Data on the country risk were collected from the site of the NGO specialized in the field (ICRG). We have monthly data ranging from 1984 to 1997 and from 2001 to 2004 for different categories of country risk. Since we work with annual data, we took the average of each risk category. These indices are calculated due to a combination of variables: thus we find the variables that relate to the cancellation of contracts by government (scale of 0 to 10), the risk of expropriation (0-10), corruption in government (0-6), law and order / rule of law (0-6) and bureaucratic quality (0-6). These criteria determine the fair and transparent legal and administrative, and therefore the underlying determinants of institutional adaptation to the IDE. The evaluation of the International Country Risk Guide (ICRG) is based on 22 variables divided into three subcategories of risk: political risk, financial risk and economic risk. These indices are constant in time for the EMCCA countries; we used the average of the data.

Data on natural resources have been collected from the website of the CEMAC, the BEAC, the "Penn World Table" and the website of the United Nations. The distance between the PI and PC noted (Dij) is collected from the website CEFI (University of Aix Marseille 2). The exchange rate between the PI and PC, the interest rate in the PC, the inflation rate of PC were collected from the Statistics Division of the United Nations. The same source can give the dummy variable set to 1 in the highly indebted poor countries and 0 otherwise. For this work, we used the software e-views 5.1". In general, a missing observation between two periods was replaced by the mean of the last ten years or five years. The data variables such as population, openness, infrastructure has been supplemented by data from the website of the University of Sherbrooke in Canada, the Information Office of the Embassy of France in Cameroon, the site of Bank of France, and websites of Eurostat and Afristat in terms of FDI. Note that log-linear model is not defined for cases with a nil or negative. Two solutions are often proposed to solve the problem of the presence of 0 in the sample: either ignores the zeros, or adding a constant to each observation on the dependent variable. We opted for the more general technique, like that used on the data of the dependent variable IDE. In the presence of a negative number in the sample, we take the smallest observation to serve as a common denominator for all observations in the sample which we add a constant. This technique has the dual advantage of both solving the problem of the presence of an observation with a value of zero or the presence of an observation with a negative value (as in the case of disinvestment in the EMCCA). This method also allows us to avoid a selection bias if the variables with zero values as the amount are not distributed in a random manner.

3.4 Statistical method for estimating

Our gravity model was originally estimated in a panel by ordinary least squares, then a fixed effect panel. These estimates raise several issues: 1) there is a strong correlation between exogenous variables and the error term. This correlation produces bias in the OLS estimator. We also note that this estimator is not convergent even in the event of non-correlation of the error term. This bias will be even higher than the variance of the individual effect is high; 2) the existence of the variables constant over time (e.g distance or dummy variable) whose fixed effect model does not adapt. For these reasons, we estimate it by generalized method of moments (GMM) has become one of the standard

econometric tests since its introduction in the econometric literature by Hansen (1982). The GMM test gives consistent parameter estimates in models where the likelihood functions are difficult or impossible to make. In addition, the tests are multiple GMM (system, fixed effect, random effect differences (Arellano Bond (1991), orthogonal deviations (Arellano and Bover (1995)), and incorporate some special cases such as linear and nonlinear instrumental variables (IV), and maximum likelihood. In order to test the joint significance of the model, we used three different methods in our estimation. In the first model (M1), the natural variables (Ln (RN) and the variables of market size (Ln (Yi, j) and Ln (Ni, j)) are introduced into the model simultaneously. In a second model (M2), Ln (RN) is not considered, while in the model M3, the variables Ln (Yi, j) and Ln (Ni, j) are ignored. We obtain finally the following three models to estimate:

First method (Model M1)

$$Ln(IDE_{ijt}) = \beta_o + \beta_1 Ln(IDE_{ijt}(-1)) + Ln\beta_2(N_{it}) + \beta_3 Ln(N_{jt}) + \beta_4 Ln(DIS) + \beta_5 Ln(INF) + \beta_6 Ln(TC) + \beta_7 Ln(ouv(-1)) + \beta_8 Ln(RN) + \beta_9 Ln(RP) + \beta_{10} Ln(INT) + \beta_{11} DUM + \beta_{12} Ln(TEL) + \beta_{13} Ln(Y_i) + \beta_{14} Ln(Y_j) + \gamma_i + \vartheta_j + \mu_{ijt} \quad (6)$$

Second method (Model M2)

$$Ln(IDE_{ijt}) = \beta_o + \beta_1 Ln(IDE_{ijt}(-1)) + Ln\beta_2(N_{it}) + \beta_3 Ln(N_{jt}) + \beta_4 Ln(DIS) + \beta_5 Ln(INF) + \beta_6 Ln(TC) + \beta_7 Ln(ouv(-1)) + \beta_8 Ln(RP) + \beta_9 Ln(INT) + \beta_{10} DUM + \beta_{11} Ln(TEL) + \beta_{12} Ln(Y_i) + \beta_{13} Ln(Y_j) + \gamma_i + \vartheta_j + \mu_{ijt} \quad (7)$$

Third method (model M3)

$$Ln(IDE_{ijt}) = \beta_o + \beta_1 Ln(IDE_{ijt}(-1)) + \beta_2 Ln(DIS) + \beta_3 Ln(INF) + \beta_4 Ln(TC) + \beta_5 Ln(ouv(-1)) + \beta_6 Ln(RN) + \beta_5 Ln(RP) + \beta_6 Ln(INT) + \beta_7 DUM + \beta_8 Ln(TEL) + \gamma_i + \vartheta_j + \mu_{ijt} \quad (8)$$

In a second step, we proceeded to estimate the models M1, M2, M3 by fixed-effects models. However, and given the fact that we have in these models of time-invariant variables (distance and dummy variable), we created a second equation, as is usual in this type of gravity model, called the individual effect (EI):

$$EI = \beta_0 + \beta_1 DUM + \beta_2 LnDIS_{ij} + \varepsilon_{ij} \quad (9)$$

Before these estimates, we also verified the stationarity of the series. The test used is a test condensed and consolidated into a single test typically used in the analysis of panel data, which gives an overview of the variables (see Table 2).

We finally made as appropriate, testing of nullity of the coefficients to see if there are unnecessary variables in the model and the null hypothesis was rejected each time, which is why we have maintained the variables we set in the various estimates.

4. Results

The results of the estimation by the generalized method of moments are presented in Table 19. This estimate gives a determination coefficient of 48% with a Sargan J statistic of 41 for the model (M1), a coefficient of determination of 50% with a Sargan J statistic of 42 for model (M2) and a coefficient of determination of 87% for model (M3) with a J statistic of 112. Note that the latter model, we have taken the version of GMM that is robust to autocorrelation. Overall, we find that the models are well specified and free of correlation and heteroscedasticity.

Economic openness is not significant in the model M1 and M3 and significant only in the absence of natural resources (model M2). It is clear that trade in the EMCCA are largely conditioned by the exploitation and export of natural resources. This can also lead to trade barriers that affect the region. Remember that in general the market of Central Africa is very close despite the introduction of the charter of the EMCCA and OHADA ratification of the plan. The many obstacles exist in these countries such as quotas, tariff barriers abusive, customs and police harassment in spite of the slogans of economic liberalization.

The market size variables are significant in the EMCCA (Ln (Y) and Ln (Nj)) then they are not in the home countries of FDI in the model M1. However, note that this significance is only possible in the EMCCA in the presence of natural resources (model M1). In the absence of natural resources (model M2), these four variables are no longer significant. So we can say that as the country is rich in natural resources, the more it is able to attract FDI and thus can benefit from the size of its market. The results can be explained by the nature of inward FDI in the EMCCA, which are primarily directed to natural resources, not by any size of the market is still not comparable to the size of the markets of other countries development such as India and China, and even neighboring Nigeria. It may be noted that the significance of market size variables in the EMCCA appears only in the GMM model. These variables are not significant in the other estimation methods (OLS and random effects presented in the tables in Appendices A13 and A14). The non significance of these variables in PI is due to the fact that if the size of the country of origin is important, it is not decisive in the investment decision is often made by specialized companies.

Natural resources are significant (5% in model 1 and 10% in model 2): a EMCCA country that has the potential of natural resources attracting FDI. By cons, as has been said before, when removing natural resources, all the variables of market size become non-significant (model 2), which is to strengthen the idea that natural resources remain in all If the input vector of FDI in the EMCCA.

FDI delayed by a period is highly significant in all models (M1, M2, and M3) can be understood to mean the ripple effect exerted by the FDI in place on FDI to come.

Infrastructure are significant in the presence of natural resources (models M1 and M3), whereas they are not in the model M2. We understand that there is a close link between the exploitation of natural resources and the availability of infrastructure.

Country risk is not significant in models 1 and 2 and significant in Model 3 with the expected sign. The non significance of country risk in the model M2 and M1 translates the problem of negative autocorrelation between country risk and the variables of market size (GDP and population). The variable "country risk" is highly significant when one removes the variables of market size which would mean that the country risk has a higher grade when GDP is particularly low.

Finally, all monetary variables are insignificant except for inflation which is weakly significant (5%) with a negative sign in the second model M2. The low significance of the inflation rate and the non significance of the same rate in the other two models (M1 and M3) also reflect the presence of FDI largely related to natural resources.

The individual effect results in the equation (7) estimated by OLS is highly significant with a determination coefficient of 84% and an adjusted coefficient of determination of 83%. The distance and debt (dummy) are significant at 1% (see Table 20). The distance has a negative and significant sign with the individual effect and reflects the fact that transaction costs have an impact on FDI in the EMCCA.

Table 1: Estimation Results by GMM method with the dependent variable ln (IDEij)

	Modèle: M1	Modèle: M2	Modèle: M3
c	-	14.5372 (0.1903)	
Ln (OUV)	0.2739 (0.5454)	16.7669(1.7556)**	0.7277(0.9004)
Ln (LTE)	0.03762 (4.1495)***	0.0180 (0.9696)	0.0149 (1.4645)*
Ln (IDE (-1))	0.5271 (5.7029)***	0.8447 (4.3394)***	0.7277(13.4711)***
Ln (Yi)	0.6497 (1.0632)	0.4426 (0.3179)	
Ln (Yj)	1.0327 (2.0554)**	0.1798 (0.3179)	
Ln (Ni)	4.8565 (1.0003)	2.1112 (-0.2099)	
Ln (Nj)	0.5153 (2.006)**	0.0042 (0.2092)	
Ln (RNAT)	1.2964 (2.0311)**		0.1470 (1.5185)*

Ln (RP)	-0.1166 (-0.08816)	-0.5558 (-1.1775)	-0.7157 (4.2411)***
Ln (TCH)	-0.1970 (-0.6760)	-0.5065 (-0.6441)	-0.1095 (-0.4915)
Ln (TINF)	-0.0048 (-0.8324)	-0.0490 (-1.7471)*	-0.0037 (-0.8102)
Ln (TINT)	0.0023 (0.4443)	-0.0041 (-0.2864)	-0.0003(-0.9280)
R^2	48%	50%	87%
Adjusted R^2	47%	48%	86%
J statistics	41	42	44

Values in parentheses refer to the Student's t tests estimated coefficient (***) significant at 1%, (**) Coefficient significant at 5% and (*) at 10%.

Table 2: Estimated model of the individual effect

Variable dépendante : IDEijt				
Nombre de variables : 105				
Variables DIS	Coefficients	Ecart-type	T de Student	Prob.
	-0.099102	0.000846	-117.1421 (***)	0.0000
DUM	0.088564	0.003937	22.49545 (***)	0.0000
R2	0.840347	Mean dept var.	-0.316845	
adjusted, R2	0.838797	S.D. dependent var.	0.046590	
S.E. of regression	0.018706	Akaike inf criterion	-5.101104	
Sum squared resid	0.036040	Schwarz criterion	-5.050553	
Log likelihood	269.8080	Durbin-Watson stat.	2.890000	

Values in parentheses denote estimated tests student ***significant student at 1%

The dummy variable representing the level of debt is significant but oddly with a positive sign. While all CEMAC countries are undergoing structural adjustment outside of Equatorial Guinea but be aware that Cameroon, Congo and Chad, although part of the heavily indebted poor countries continue to borrow to invest, or to buy shares in foreign firms. Thus, the equity of Chad and Cameroon in the implementation of the pipeline Chad-Cameroon was made possible by a bank loan taken out by these two states. This loan has allowed each to have a hand in the operation: 5% to 10% for Chad and Cameroon (55% against the U.S. and 30% for Malaysia).

The country effect (see Table 3) shows that the PI has a positive coefficient with some EMCCA countries such as Cameroon, Gabon and Chad, while the Congo, Equatorial Guinea and EMCCA in general have a negative sign which is ambiguous.

Table 3: countries effect

(γ_i, ϑ_j)	Coefficients
PI	0.092500
Cameroon	0.558505
Congo	-0.368442
Gabon	0.189506
Equatorial Guinee	-0.326047
Chad	0.109973
CEMAC	-0.255994

γ_i, Représente le groupe des pays d'origine (PI) des flux d'IDE et ϑ_j les pays d'accueil des flux d'IDE.

5. Conclusion

In conclusion, we can say through the different models (M1, M2, M3) estimated that natural resources are by far the most significant determinant of FDI in the EMCCA. Market size (population and gross domestic product) may also play a role in attracting FDI in addition to natural resources. Economic growth can bring new opportunities for FDI, but in the current state, the market size of EMCCA would have difficulty in attracting FDI in the absence of natural resources. In the same vein, the infrastructure plays an important role in the attractiveness of FDI. Economic openness is not decisive in terms of attractiveness, as the EMCCA countries are still relatively closed compared to other developing countries. Finally, the monetary variables are generally "passive" and act little on FDI flows may be due to the EMCCA membership in the franc zone, which dictated his conduct and made her the running of a monetary policy that it does not totally control.

References

Aitken, B. and Harrission A.(1999), "Do Domestic Firms Benefit From Direct Foreign Investment ? Evidence From Venezuela", American Economic Review, 89, pp. 605-18.

Andrew, K. R and Spiegel, M. M., (2003), "A Gravity Model of Sovereign Lending: Trade, Default and Credit", Working paper.

Arellano, M. and S. Bover (1995), 'Another Look at Instrumental Variable Estimation of Error-component Models', Journal of Econometrics, 68, 29-52.

Assiedu, E. (2002), "On the determinants of foreign direct investment to Developing countries: Is Africa Different?" World Development, 30, pp.107-19.

Basile, A. (2004), « Contraintes et Perspectives de L'investissement étranger Direct dans L'espace CEMAC ». Rapport établi sur la demande de la CNUCED, Septembre 2004, Genève.

Baniak, A., Jacet C and Jan H., (2002), « On the determinants of Foreingn Direct Investment in Transition Economies » Working Paper.

Basile, A. (2004), "Contrainttes et perspectives de l'investissement étranger direct dans l'espace CEMAC". Rapport CNUCED, Septembre, 2004, Genève, Suisse.

Bergstrand, Jeffrey H. (1989), "The Generalized Gravity Equation, Monopolistic Competition, and the Facto-Proportions Theory in International Trade", the Review of Economics and Statistics, Vol. 71, No.1, pp. 143-153.

Bond S., Hoeffler A. and J. Temple (2001), 'GMM estimation of empirical growth models' CEPR discussion paper n. 3048.

Chakrabarti A. (2001), "The Determinants of Foreign Direct Investment: Sensitivity Analysis of Cross-Country Regressions", Kyklos, 54, 89-114.

Cheng Hsiao (2004), "Panel Data Analysis: Advantages and Challenges" Department of Economics, University of Southern California, USA.

Coughlin, C. C. and E. Segev (2000), 'Foreign Direct Investment in China: A Spatial Econometric Study', the World Economy, 23, 1, 1-23.

Dunning, J. H., (1988), "The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions." Journal of International Business Studies 19:1, pp.1–31.

Dupuch, S. (2004), " Les investissements directs étrangers dans les nouveaux pays adhérents à l'Union européenne, Région et Développement, n°20, 45-64.
Froot, Kenneth, Stein and Jeremy (1991), "Exchange Rate and Foreign Direct investment an imperfect capital markets approach", Quaterly Journal of Economics, Vol.196.pp.1191-1218.
Globerman, S., Shapiro, D., Tang, Y. (2004), "Governance and Foreign Direct Investment in Emerging and Transition European Countries".
Hassane, B. H et Zatla N. (2001), « L'IDE dans le basin méditerranéen, ses déterminants et son effet sur la croissance ». Synthèse du rapport de recherche, contrat FEM-REF/99/B2-04.
Mallampally P., K. and Sauvant (1999), "Foreign Direct Investment in Developing Countries", Finance and Development, Vol.36, n°1.
Mafizur, M. R. (2006), "A Panel Data Analysis of Bangladesh's Trade: The Gravity Model Approach". University of Sydney, NSW 2006, Australia.
Markusen, J.A. Venables, Konan D., and Zhang K., (1996). "A Unified Treatment of Horizontal Direct Investment, Vertical Direct Investment and the pattern of Trade in Goods and Services". NBER Working PAPER n); 5696?
Ngouhouo, I., Khaled El M. and Sa'adi S. (2005), "Does FDI means productivity growth For The Host Country ?" American Journal of Business and Management.
Oguledo I.V. and MacPhee C.R. (1994), "Gravity Models: a Reformulation and an Application to Discriminatory Trade Arrangements", Applied Economics, Vol.26, pp. 107-120.
Rugman, A. (1980), "Internalization as a General Theory of Foreign Direct Investment: A Reappraisal of the Literature." Weltwirtschaftliches Archiv, Vol. 116, No. 2, 365–379.
Saskia, K.S.W. (1998), "Foreign Direct Investment And its Determinants in Emerging Economies", United States Agency for International Development Bureau for Africa, Washington, D.C.
Sekkat, K. and M. Veganzones-Varoudakis (2005), « Trade and Foreign Exchange Liberalization, Investment Climate and FDI in the MENA ». Working paper DULBEA.N°5.
Servers, L. and Solimano, A., (1992), "Private Investment and Macroeconomic adjustment: A Survey", The World Bank Research Observer, Vol. 7, N°.1, January.
Stiglitz, J., 2002. Globalisations an its Discontents, Allen Lane, London.
Urata, and Kawai, H. (2000), "The determinants of the location of foreign direct investment by Japanese small and medium-sized enterprises", Small Business Economics, 15, 179 – 103.
Wang, Z. Q. And Swain, N., (1995), "The Determinants of Foreign Direct Investments In Transforming Economics: Empirical Evidence From Hungary and China". Weltwirtschaftliches Archv. 131: 358-82.
Westerlundy, J. and Walid H. et Safarian A.E, (1999),"Modelling Links between Canadian Trade And Foreign Direct Investment", Perspectives On North American Free Trade. Industry Canada, Research Publications
Wilhelms, Saskia K. S. (1988), "Institutional FDI Fitness: Determinants of Foreign Direct Investment to Emerging Economies". PhD Thesis. Medford, MA: Fletcher School of Law and Diplomacy.