Foreign Direct Investments and Individual Income in Central Africa

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Abstract *This article employs a panel of double ordinary least squares to verify the sensitivity of income per capita to the influx of foreign direct investment (FDI) in the Economic and Monetary Community of Central Africa (EMCCA). Equally, it uses the granger causality test based on the auto-regressive model, most especially the one recently developed by Toda and Yamamoto (1995) to establish the causality links between FDI and per capita income in the Economic and Monetary Community of Central Africa. Results obtained show that there exist a direct effect between FDI and income per capita in the entirety of EMCCA. The granger causality test shows contrarily that there is no link between FDI and income per capita in the EMCCA countries whereas the Toda-Yamamoto finds a symmetric link among these variables in Equatorial Guinea, a unidirectional link of FDI towards income per capita in Congo, Gabon and Chad; and no link between the variables in the Republic of Central Africa and Cameroon.*

Keywords: FDI, income per capita, Mwald, bi-varied VAR, doubled Ordinary Least Squares.

1. Introduction

The effects of foreign direct investments (FDI) in the Economic and Monetary Community for Central Africa (EMCCA) zone are appreciated differently. Whereas many agree on the fact that it constitutes one of the principal catalysts of development because of the liquidity that it brings into a zone which has been performing weakly, others hold contrarily that multinational companies (MNCs) constitute a dual economy and even create a phenomenon of eviction of local companies. The advantages that come along with MNCs are not automatically manifested and are not equitably distributed among economic sectors and countries. For FDI to have positive maximum effects, it is necessary and obligatory for the recipient countries to put in place generally favorable investment conditions and to re-enforce the necessary institutional and human capacities for its exploitation.

In the framework of the neoclassical model of Solow (1956), FDI had a long run influence on the rate of growth per capita and not on the rate of growth because of the presence of a stationary state. Contrarily, the endogenous growth models elaborate a new theoretical framework where technical progress is endogenous, that is returns are increasing and the marginal productivities of productions factors are greater than one. From these works, many empirical studies have been carried out to study the impact of the influx of FDI on income per head in developing countries with diverged results (the effects of the existence of FDI and the spillovers experienced in the recipient countries) whereas others have studied the nature of the causal relation between FDI and economic growth.

Similarly, Carkovic and Levine (2002) found no relation between growth and FDI in a sample of World Bank countries. Tackling in the same direction, Chowdhury and Mavrotas (2003) found that FDI does not lead to growth as investigated by Granger in Chili, whereas this causality relation is bi-directional in the case of Malaysia and Thailand. Other studies in the search of a relation between FDI and growth have indicated ambiguous results above all from the majority of studies carried out by CNUCED (1999). In this manner of ideas, Zhang (2001) carried out findings with the aim to determine the direction between FDI and growth in 11 Asian-Latin American countries. This author used temporal series particular to each of the countries and

conducted long run causality tests based on the error correction model. The results indicated that no relation existed between FDI and growth in Argentina in the short run whereas such a relation existed between growth and FDI in Brazil in the short and long run in Colombia. For the Asian countries, the author found a short run relationship between growth and FDI in Korea, Malaysia and Thailand. In summary, five of the eleven countries studied, FDI accelerated growth. For the six countries, there was no co-integration relation between FDI and growth, only one country exhibited a causality relation between growth and FDI. In the same order of ideology, an econometric study carried out by Nair-Reichert and Weinhold (2001) using the Holtz-Eakin causality test in a panel of 24 developing countries between1971 and 1995 found no causal relation between FDI and growth.

Loesse (2005) in the search for a relationship between FDI and economic growth in Ivory Coast found that from 1970 to 2001, foreign direct investments were an important source for growth. Other things being equal, a unit percentage of supplementary FDI entering Ivory Coast leads to an increase of 0,01 percent of gross domestic product per head. The author holds that the policy of encouraging investment put in place contributed to increase the influx of FDI, thus the productive capacity of the economy consequently the increase of gross domestic product.

In analyzing the impact, some authors held that the effects of FDI were positive in the distribution and amelioration of workers' income somehow.

The positive impacts of FDI were verified in the domain of redistribution of wealth and income in some developing countries like Botswana contrarily to other countries such as Democratic Republic of Congo and Angola where multinational agencies acted either by corrupting politicians or by buying arms for the countries (Mold, 2004).

In EMCCA, measures taken in 1999 following the adoption of the Structural Adjustment Program (SAP) were aimed at rendering the economy more competitive and credible before eventual investors. The economic openness that followed these measures and the discovery of petroleum deposits notably in Equatorial Guinea and Chad had as effect an increase in FDI in the zone. Since then, there has been an important economic growth with at the rate of about 6% from 1995 which led to an improvement of income per capita in all the countries of the zone. Is this increased revenue of the citizen linked to the influx of FDI? Will this situation which existed almost a decade ago due to investments influx into the petroleum sector survive alongside the crisis which the exploitation sector of EMCCA is experiencing? We attempt to answer these questions in the course of this study.

In section1, we present the trends of FDI and gross domestic product (GDP) per capita in EMCCA. Here the stress in on the amounts of influx of FDI into EMCCA, their distribution according to sectors as well as the evolution of income per capita in the zone. We present equally in section 2 a methodology based on structured empirical models as follows: a multiple regression model that analyses the impact of FDI on income per capita in the zone in a panel of doubled least squares and a bi-varied model which will allow us to have the nature of causality link between the two variables, whereas section three analyses the results of the study.

2. Trends of GDP per Capita and FDI Influx and Distribution According to Sectors in EMCCA

The evolution of FDI influx into a given country or region is a function of several parameters such as economic and political stability, the population dynamism and its technical know-how and above all a certain factorial endowment in terms of natural resources for developing countries. Generally, the African continent attracts less FDI even though some countries are exceptions. From all FDI influx, only 40% went towards developing countries in 2005 and only 0,48% went towards Central Africa (EMCCA zone). It is therefore clear that in terms of volume of influx, the Central Africa share remains marginal at the world level. However, in a considerable manner, these influxes have economic importance for these countries. The introduction of SAP by the International Monetary Fund (IMF) and the World Bank at the beginning of the 80s was a take off point

for a large openness of Central African Economies. Notably, important foreign direct investments have financed the production and exploitation of natural resources especially gas, hydrocarbon and wood in the five oil producing countries of EMCCA. In effect, since the world boom of FDI, few studies have been carried out in Sub-Saharan Africa above Central Africa.

   The amounts of foreign direct investments in EMCCA are insignificant as compared to the rest of the world (see diagram 1). FDI towards Central Africa witnessed a gradual increase after 1991 and went on to attain a boom from 1999 thanks to the construction of the Cameroon-Chad pipeline project. Central Africa, above all five of the six countries of the EMCCA zone excluding Central African Republic received 20% of World's FDI in Africa in 2004, which was 80% of World's FDI in the Franc zone and 46% in the French – Africa zone representing 82% of French FDI in the franc zone. (See table 1). In 2003, CNUCED estimated the influx of FDI into Cameroon at 215 billions of franc CFA as against 86 billion in 2002 which was 13,8% of gross fixed capital formation whereas the stock of FDI for the same period stood at 1,7 billions of US dollars making 13,9% of gross domestic product.

Table 1. Percent of the World's and French FDI towards EMCCA in 2004

Origin / Destination	World's FDI	EMCCA share	French's FDI	EMCCA share
Africa	3	20	4.9(ASS)*	46
Franc zone	1	80	1	82

*Africa south of the Sahara. Source: Afristat.

Table 2. Amount of world's FDI towards EMCCA between 2000 & 2005 in millions of US $

| years / Amounts	2000		2005		Increase in value		Increase rate	
	FDI influx	FDI Stock	FDI influx	FDI Stock	FDI influx	FDI Stock	FDI influx	FDI Stock
EMCCA	378	4527	3285	13143	2907	8616	769%	190,3%

 Source: Franc zone institute (FZI) and UNCTAD (2005).

The total amount of FDI entering the EMCCA increased from 378 to 3285 millions of US dollars between 2000 and 2005 indicating an increase of 2769%. At the same time, FDI stock moved from 4527 to 13143 millions of dollars, showing an increase of 190% (table 2). In 2003, following the discovery of enormous oil deposit and an offshore reserve of more than 10 billion barrels, Equatorial Guinea suspended all economic observatory by positioning itself on top of Sub-Saharan African Countries in as much as the entering of FDI

which stood at 1431 million of US dollars as against 323 in 2002. It performed well again in 2004 with 1664 million of US dollars. In 2004, Equatorial Guinea was ranked at the 47th world position among recipient countries of FDI, with 0,26% of FDI influx in the world and 9,52% of FDI destined towards Africa. After recognizing some stability in the 1990 decade of about 50 million of FDI per year, FDI towards Chad increased to 115 millions of dollars in 2000. This trend accelerated in 2001 and in 2002 where the influx of FDI were 460 and 924 millions of dollars respectively before being decreased to 713 and 478 millions of dollars respectively in 2003 and 2004 according to United Nations. In Congo, FDI witnessed a record level of 668 millions of dollars which has never been experienced since independence. Similarly, Gabon seemed to have witnessed a level of FDI influx after a slow down period at the start of the 1990 decade, which was estimated at 559 millions of dollars of FDI that entered Gabon between 2002 and 2004.

In this regard, FDI towards EMCCA is unevenly distributed in the four principal sectors of economic activities: primary, mining and hydrocarbon, manufacturing and tertiary. In some countries like Cameroon, petroleum has often been assimilated to the industrial (secondary) sector, but for some years now and taking into consideration the importance of this resource in the economy of each country of EMCCA, petroleum is considered as a particular sector. The sectoral division has been very volatile from year to year and even within each country of the zone. In 2004, FDI towards EMCCA was estimated at 3171 millions of dollars and from this amount about 85% was invested in the mining and hydrocarbon sector, 11% in the industrial (manufacturing) sector and about 4% in the tertiary or services sector

Diagram 1.
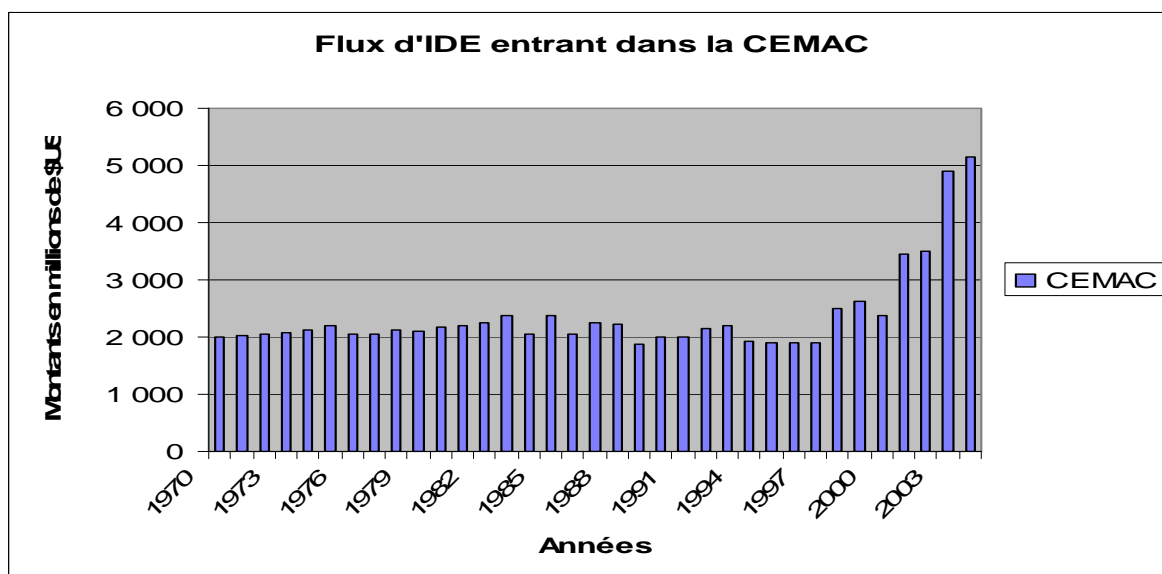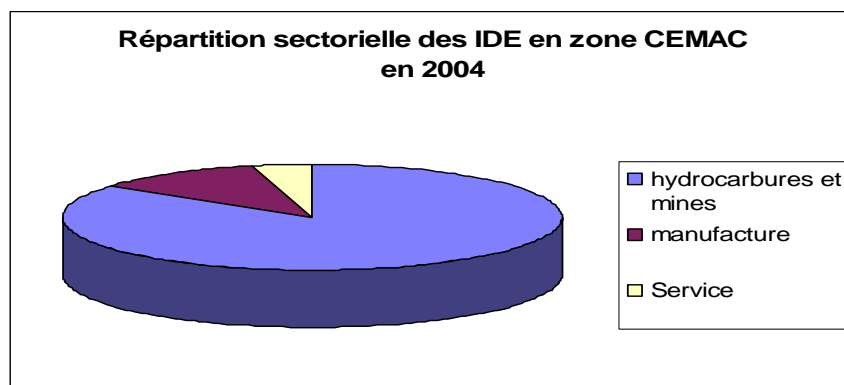

Source: Diagram realized by authors from CNUCED data
NB: In the above diagram, Flux d'IDE entrant dans la CEMAC= Influx of FDI into EMCCA; CEMAC = EMCCA; Annees = years; montants en millions de $ = amounts in millions of dollars

FDI remains strongly concentrated in some petroleum exporting countries. EMCCA has suffered and continue to suffer from the effects of civil war, macroeconomic instability, corruption which restrict the inflow of FDI. Since, the problems of regional integration have had negative consequences on the development of these countries because of weak domestic market, railway infrastructure, production costs and wages which are relatively high.

However, the recent boom of FDI into the EMCCA zone is accompanied by an increase of income per capita in the entire region. Thus, average income of the zone has moved from 116 to 3346 US dollars in 2008

indicating an increase of 300% in five years. All the same, the Cameroon economy which alone contributes about 40% of GDP in EMCCA receives just a small share of FDI towards this region and consequently its income per head increases very slowly. After an improvement at the beginning of the 80s (1200 dollars), its GDP per capita dropped to 526 dollars in 1994 at the times of deep economic crisis and today(2008) is found at 950 dollars. As concerns Gabon, FDI influences growth through the threshold of income per head. Gabon has remained for a period of more than 40 years the richest country among EMCCA countries in terms of income per capita compared to Sub-Saharan Africa excluding the Republic of South Africa with a per capita income of 4500 dollars whereas Equatorial Guinea with a lot of petroleum resources has become within five years the richest African country with GDP per capita to the neighbor of 1300 dollars in 2008. Have the consequences of economic crisis with the fall of the price per barrel of oil change the situation in 2009? Congo where petroleum resources are in constant increase has equally benefited from an improvement in its GDP per capita which claimed from 528 dollars in 2004 to 2500 dollars in 2008, indicating an increase of 500% within five years. The same trend was witnessed in Chad where income per head moved from 197 dollars in 2001 to 530 dollars in 2008 thanks to the influx of FDI into the petroleum sector. The Republic of Central Africa (RCA) which has not benefited from massive influx of FDI due to the lack of petroleum resources as noted among other EMCCA countries is the only with low GDP per capita but with regular growth. From this analysis, we found out that income per capita within EMCCA is very volatile and largely depends on the influx of FDI of the petroleum sector. The financial crisis will largely go to influence the external sector of EMCCA because FDIs entering this sector are in net reduction notably in the exploitation of wood where orders are not only scare but those already ordered are on daily basis revoked in the region, which do not go without consequences for the countries. The question we can ask at this moment is whether these facts witnessed are empirically verified?

Diagram 2

Répartition sectorielle des IDE en zone CEMAC en 2004
- hydrocarbures et mines
- manufacture
- Service

3. Empirical Model

On the one hand, the empirical model is elaborated with the aim to analyze the impact of FDI on the income per capita and the causal relationship between FDI and income per head. The first model is a multiple regression which is best adopted for impact analysis, whereas the second is the VAR model which takes into consideration the interdependence between the concerned variables.

2.1 Modeling the Regression Through Doubled Least Squares (DLS)

In the framework of our analysis, we use a multiple regression model with income per capita as endogenous variable and foreign direct investments, inflation rate, and interest rate on human capital as exogenous variables; and a dummy variable which takes care of forgotten elements in the model. This model is estimated with the use of data from five countries of EMCCA in a panel of autocorrelation and

heteroscedasticity of doubled robust ordinary least squares. It should be noted here that for a dynamic model, the Durbin Watson (DW) is not valid, reasons for which we have opted for the neutralization of autocorrelation and heteroscedasticity through the White robust model of doubled least squares which is equivalent to the method of generalized moments. The estimated model is:

$$Ln\,(IPC_{it}) = \beta_0 + Ln\,(IPC_{it}(-1)) + Ln\,(FDI_{it}) + Ln\,(HC_{it}) + Ln\,(INF_{it}) + Dum_{it} + e_{it}$$

Ln (IPC $_{it}$): annual growth rate of GDP of country i.
Ln represents the logarithm

Ln (HC $_{it}$): available human capital in country i at time t.
Ln (FDI$_{it}$) : influx of FDI in country i at time t.

Ln (INF $_{it}$): inflation rate in EMCCA

Ln (INT $_{it}$): 'interest rated in 'BEAC' as an instrumental variable
Dum: dummy variable
i =1………….i =N represents each of country EMCCA
t = 1970………….t =2008: temporal indices.

β_0 : Constant term.

e_{it} : Error term.

Income per Head; Ln(IPC)

The national income per head is equal to the total national income divided by the number of inhabitants. As different from the GDP per head, it integrates the revenue of indigenes living abroad and subtracts that of foreigners living within the national territory including repatriated profits of multinational companies. Nevertheless, national income is very important in African countries because of many foreign workers who live abroad and who repatriate their earnings to their countries of origin. The aim of the evaluation here is t know if FDI favors directly or indirectly the increase of national income per head in EMCCA.

Inflation Rate: Ln (INF)

The rate of increase of consumption prices[1] is a factor which seems directly implicated in situations of over liquidity. In the empirical literature, we realize that a high rate of inflation often leads to a negative relationship with FDI and vice versa for a low rate. Considering the difficulties faced by a majority of EMCCA countries in the act of respecting the convergence criteria in matters of inflation rate, we anticipate a negative sign between FDI and inflation in EMCCA.

Interest rate: Ln (INT)

Interest rate measures the borrowing capacity of local resources by foreign investors. Therefore the lower it is, the more the influx of FDI. The dimension of the link between interest rate and FDI changes however according to the existing regime. Within the EMCCA zone where interest is often considered partially passive, that is why this variable is used here not as an instrumental variable.

Human capital: Ln(HC)

Countries that are endowed with a qualified critical mass of human resources have had a rapid growth and consequently a high per capita income. The human development index was studied between 1970 and 2008 in EMCCA and we have considered this as a proxy for human capital. We now verify whether there is an eventual positive effect of FDI on human capital.

Foreign Direct Investments: In (FDI)

The endogenous variables lagged by a period are equally considered as explanatory variables in the model. Furthermore and to the interest of the model, an endogenous variable is often considered as an explanatory variable in another equation. As concern the instrumental variables, the choice is very delicate and that is envisaged in many of the econometric manuals (Greene, Maddala), the exogenous variables (lagged or not) and the lagged endogenous variables are the good instruments and consequently are retained. The regression would have as instruments the lagged endogenous variable by one or two period; and non-lagged exogenous variables, their true values and the same values lagged by a period.

The dummy variable is used here as an auxiliary variable of the institutions. It takes the value 1 during the periods when the institutions are favorable for the influx of FDI (civil regime) and zero elsewhere.

3.2 Modeling of the Causality by the VAR Model

Having given that FDI is susceptible to be attracted by the amount of income per capita of a country, the observed relations could be in general manner be suffering from causality problems of which one of the very important is the omission of important explanatory variables of the income per capita. The VAR model is the most efficient consumption price indices in the EMCCA countries when the number of variables is reduced as in the case of our analysis, further this model allow us to say whether the causality is unidirectional or bidirectional. Considering the methodology plan, it appears also that some economic studies have violated the act because they are not rigorous.

1) Many authors have used a group of heterogeneous countries in a panel analysis, whereas these countries could have been chosen according to well defined criteria. Cross-sectional studies between countries assumed a certain common economic structure which is far from being the case.
2) The absence of preliminary tests in some studies lead to some biased results.
3) The use of panel model in place of this one in temporal series or vice versa is not always justified.
4) Causality studies lead to diverged results which could be attributed to two principal causes: i) the choice of the number of lag in most of the studies is arbitrary (Kasibhatla and Sawhney, 1996); ii) the use of Fisher's statistical test to verify causality, whereas it is well established in our days that this test is not valid if the series are integrated of order one (I(1)) as stressed by Zapata and Rambaldi (1997) and Gujarati (2004). Further, a majority of studies based on chronological series scarcely examine double causality, which gives simply a partial view of the possible economic relationships (Zhang, 1995). We attempt to take into consideration these shortcomings in the cause of our econometric analysis by verifying the following model:

$$Ln\,(IPC)_{it} = \beta_{à} + \beta_1 Ln\,(IPC\,(-1))_{it} + \beta_2 Ln\,(FDI)_{it} + e_{it}$$
$$Ln\,(FDI)_{it} = \mu_{à} + \mu_1 Ln\,(FDI\,(-1))_{it} + \mu_2 Ln\,(IPC)_{it} + \varepsilon_{it} \qquad \text{(Equations 1 et 2)}$$

We are using above the Augmented Dickey-Fuller (ADF, 1981) test of estimation to verify for unit root. Blough (1992) held that unit root tests could falsely reject a null hypothesis of non stationary whereas growth or FDI possess a weak force against the alternative hypothesis. That is due to the fact that in finite

samplings, it was found out that certain processes of unit roots exhibit a closed behavior to the stationary process of the White noise. These methodological problems are as result due to the use of critical values based on the asymptotical distribution of Dickey-Fuller. Therefore, taking note of these potential problems in the verification of unit root, we have used the results of KPSS test as described in Kwiatkowski et al.., (1992) with the intention to confirm the validity of the results of the Augmented Dickey-Fuller test. This test allows us in effect to know whether the ADF test is valid and we use the appropriate information criteria of (Akaike information criteria and Schwarz, the resemblance ratio, etc) with the aim to determine the necessary lag structures to the series under study. These information criteria give a value of one as the number of appropriate lag to the different series of the model.

As we know, a causality test starts by a co- integration test and if it appears that the variables are of order I(0) as it is the case here, the causality test is based on an estimated model in first difference as below:

$$\Delta Ln \ (IPC \ )_{it} \ = \ \beta_0 \ + \ \beta_1 \Delta Ln \ (IPC \ (-1))_{it} \ + \ Ln \ \Delta \ (FDI \ )_{it} \ + \ e_{it}$$

$$\Delta Ln \ (FDI \ )_{it} \ = \ \mu_0 \ + \ \mu_1 \Delta Ln \ (FDI \ (-1))_{it} \ + \ Ln \ \Delta \ (IPC \ )_{it} \ + \ \mu_{it} \qquad \text{(Equations 3 and 4)}$$

Contrarily if the variables are of order I(1), the causality test is estimated according to the error correction model (ECM). Thus, a change in the income per capita is a function of a change in the past income per head and a change in the foreign direct investments. Equally, any change in FDI is a function of a past change in the FDI and income per head. In the context of this model, we say that FDI granger cause income per capita if we can reject the null hypothesis that the μ_{it} , i =1,….6 are jointly null. Also, we conclude that income per capita granger cause FDI if we can reject the null hypothesis according to which all β_{it} are jointly null with i = 1,…..6.

2.3 The Statistical Data

In this paper, we have used data from 1970 to 2008 for the six countries of Central Africa which include Cameroon, Gabon, Central Africa Republic, Congo, Equatorial Guinea and Chad. It is true that in the EMCCA just as in all developing countries, the paucity of statistical data constitute the principal limitation confronted by researchers and this study is not an exception. The data on FDI were collected from the Central Africa Bank and they constituted the net influx of FDI into EMCCA and are transformed to log form; which are from the World Bank. The data on income per capita were collected from the PENN World Table website and are expressed in constant US dollars. The inflation and interest rates were extracted from the United Nations statistical division. These data were treated and refined according to the habitual techniques before the estimations. When an observation was missing between two values in a series, we used the interpolation method to arrive at it. When the missing values were many, we estimated them by attributing the averages of the last 10 years, if not the last five years. The exchange rate used in this paper is the official rate between the Euro/the dollar and the franc CFA that is a Euro/dollar at 650/550 franc CFA. It should be noted that a fixed parity exist between the Euro and the franc CFA, whereas this does not exist between the dollar and the franc CFA. Equally, the stability of the variables Ln (IPC), Ln (FDI), Ln (HC) was verified. In effect, all the roots were found within the unitary circle and satisfied the stability conditions in all the countries taken individually and in the EMCCA zone taken as a whole.

3. Results

3.1 The impact of FDI on Income per Capita

The results of the model presented on table 3 give an adjusted coefficient of determination of 99%. The test gives a globally significant result with a J statistic of 212. In this case, a change in FDI brings about a change

of income per head in the same way. The result obtained shows that the behavior of FDI can play a certain role on the standard of living in EMCCA countries. In effect, the recovery of the petroleum prices and other raw materials coupled with the new discovery of oil deposits has revamped since a decade the influx of FDI and the level of income per head and has multiplied these values in some countries of the zone two to three times (section 2). The inflation rate and human capital as well as income per head lagged by a period are also significant with an aberrant sign for human capital. Apart of human capital, all the other variables are directly linked to income per capita in the EMCCA. In other words, the more a country benefits from a massive influx of FDI in the EMCCA and has good institutions, the higher the income per head in the country.

At the country level, income per head has witnessed an unimaginable boom in Equatorial Guinea thank to the influx of FDI into the petroleum sector; whereas it was just 200 dollars per year a decade ago, the income per head of an Equatorial Guinean is estimated actually at more than 9000 dollars per year because of the influx of FDI into the petroleum sector. The educational level has well improve due to the increase of income and many youths more and more go for further studies abroad sponsored by the state which was impossible ten years ago. This result is however disturbing as there is a marked inequality in the distribution of income in favor of the ruling leaders. The income per head is also directly linked to FDI influx in Congo where income per head is ranked third after Equatorial Guinea and Gabon in the EMCCA. In the same order of reasoning, the national income per head in Gabon has remained for a long time one of the highest in Africa thanks to FDI. Gabon has been the first country to receive per inhabitant FDI for more than twenty years and the decrease of FDI in the 90s caused to reduce the income per head in the country. More than 60% of the population by 1999 lived below the poverty threshold, with monthly income less than SMIC 64 000 francs CFA (97,567 Euros).

Equally, the improvement of the income per head is also net in Chad since the FDI boom from the ending of the 90s. In effect, the income per head of this country has moved from 193 in the year 2000 to 630 dollars in 2005 due to the influx of FDI into the petroleum sector.

The situation in Cameroon is not similar to that of the other countries of EMCCA because this country benefits less FDI due to its low petroleum production. A quarter of the budget in 2006 in Cameroon came from the petroleum sector, as against 80% in the other countries of EMCCA. In the same manner, Central Africa Republic which receives less FDI because of the absence of hydrocarbons endowment has the least income per capita in EMCCA...

Table 3. Estimation of the national income per head equation

Dependent variable: LOGIPC				
Method: Panel Two-Stage EGLS (Cross-section SUR)				
Date: 19/08/11 Time: 00:57				
sample (adjusted): 1972 2008				
Number of countries included: 6				
panel equilibrium of 222 observations				
Linear estimation after one-step weighting matrix				
White cross-section standard errors & covariance (d.f. corrected)				
List of instruments: C LOGIPC LOGIPC(-1) LOGIPC(-2) LOGFDI				
LOGFDI(-1) PRO INFR INFR(-1) HC(-1) INTR INTR(-1)				
Variables	Coefficients	Standard deviation	Statistic	Probability.

C	0.223492	0.069619	3.210243	0.0015
LOGIPC (-1)	0.941300	0.031844	29.56014	0.0000
LOGFDI	0.002508	0.000820	3.058474	0.0025
PRO	0.051375	0.018213	2.820737	0.0052
INFR	0.000983	0.000506	1.943549	0.0533
HC	-0.243980	0.183673	-1.328339	0.1855
Specification of effects				
Cross-section fixed (dummy variables)				
Robust statistics				
R-squares	0.998149	Dependent variable mean		26.19901
Adjusted R squares	0.998062	S.D. dependent variable		23.02096
Standard deviation of the regression	1.013501	Sum squared residual		216.7358
Durbin-Watson stat	1.959472	J-statistic		206.4838
Instrument rank	17.00000			
Non robust statistics				
R- squared	0.967004	Mean of the dependent variable		2.775768
Squared error residuals	1.752047	Durbin-Watson statistics		1.963596

3.2 Causality Analysis Between FDI and Income per Capita

3.2.1 Stationarity and Co-Integration

The stationarity test shows that the FDI series is stationary in Congo, Cameroon, Equatotrial Guinea, and Chad and in Central Africa Republic whereas the IPC series is not stationary in Gabon and Cameroon. Table 4 gives a precise idea of the Augmented Dickey-Fuller test. That of Philip Perron gives sensibly the same results. The stationarity of series are at level, therefore are integrated of order 0 (i.e. I (0)), whereas the others are stationary at the first difference thus integrated at order 1 (i.e. I (1)). As we mentioned earlier above the co-integration is a precondition for the causality test. The Johnson co-integration test is preferred to that of Augmented Engle Granger in this study because where the first is conducted in the context of a VAR model that we have used here. The selection of the lagged number was executed taking into account the minimum value of several criteria, and a unanimous result of the criteria recommends considering 1 as the retained lag for all the variables in all the countries. Table 5 shows the result the Joyansen trace test and the eingen-value maximum test of the same author in the six countries of EMCCA. The logFDI and the logIPC are stationary in Cameroon whereas in the other EMCCA countries, only the logFDI is stationary as shown by table 4. We know equally that the unit root and co-integration tests are not very strong when we have less than 100 observations (Maddala and Kim 1998, 219), reason for which we equally went further to the Philip Perron test, which confirmed the results of the ADF test.

Two co-integration tests were equally conducted for each country of the EMCCA with the aim to test for causality; that is the trace test and the eigen-value test of Joyansen. The first is found on table 5 and it indicates with null hypotheses the existence of 0 co-integrated vector and more, one vector must be rejected at all times for Cameroon and for Gabon, whereas this test is not rejected for Congo, Chad, Equatorial Guinea and RCA where it admitted a co-integrated vector.

3.2.2 Causality Analysis

The Granger causality test shows that there is no causality link between FDI and income per capita in the countries of EMCCA. Consequently, FDI does not cause income per capita and vice versa for income per capita. This situation could be explained partly by the small sample used for this analysis and partly by the fact that the history of FDI in some countries like Chad and Equatorial Guinea which are however the first recipients of FDI in Central Africa dates less than a decade of years. Nevertheless, a second estimation by the modified Wald method (MWald) developed by Professors Toda-Yamamoto (1995) and by Dolado and Lutkepohl (1996) were conducted. This method consisted to estimate the VAR model at level with the advantage that we do not worry to know if the series are stationary or not or whether there are integrated or co-integrated. The only thing to do is to determine the maximum order of integration of the VAR model which could occur in the course of the estimations called (d-max) and undervalue intentionally the model at level with an additional lag (d-max) i.e VAR (p), with p = k=d. The habitual test of Wald is also carried out on the first matrices coefficients using the two standards Chi statistical tests (see table 8). This test is well appreciated for its simplicity according to Rambaldi and Doran (1996). The only inconveniency of this test as stressed by Zapata and Rambaldi (1997) is the loss of the power of test in reduced samples. It is therefore useful to compare the result of this test to that based on the VAR at first difference. Thus, table 8 confirms the result in Cameroon and the one of RCA. In effect, these two countries are those receiving less FDI, the first for its low petroleum resource potentials and the second for the total absence of the resources. Contrarily, the results of Gabon and Equatorial Guinea which are the two richest countries in petroleum resources in EMCCA show that a bidirectional or symmetric causality between FDI and Income per capita for Equatorial Guinea, and unidirectional causality of FDI towards the income per capita for Gabon. We experience equally a change in the result of Congo and that of Chad. Foreign direct investments directly cause income per capita in these two countries, whereas the inversed relation is not verified.

In total, we realize that FDI directly cause income per capita in four of the six countries of EMCCA, which are Gabon, Chad, Congo and Equatorial Guinea. This causality is symmetrical in Equatorial Guinea, whereas there is no causality link between FDI and Income per capita in Cameroon and RCA. It is equally necessary to point out that the countries where this causality exists are those with more natural resource endowments and consequently receive more FDI. These FDIs are concentrated in the petroleum sector and in the trade for wood. These results conform to most of the results obtained in the previous studies i.e there is no official rule for these causality analyses in developing countries. The results vary from country to country and even in the same country, this result is sensitive to the methodology used (number of lag used in the VAR model, samples, etc). However, the essential question is that to know whether the improvement witnessed in the income per capita thanks to FDI could sustain the financial crisis. In effect, the financial crises which have become economic crises limit dangerously the influx of FDI in EMCCA. Wood orders are being reduced and we cannot even count the many contracts revoked between foreign investors and local businessmen, nevertheless, it is difficult to say what will be the consequences of this crisis on the economy of EMCCA.

4. Conclusion

Our general conclusion is that influxes of FDI towards Central Africa remain very low (1% in relation to World's influx and represents only 20% of FDI influx into Africa). The FDI influx into EMCCA have remained stable at an average level of 35 millions of dollars per year and per country between 1960 and 1970, and have increased gradually with the discovery of oil in Congo, Gabon and Cameroon. This increase accelerated at the end of the 90s with the discovery of petroleum in Chad and Equatorial Guinea, making EMCCA to be one of the privileged destinations of FDI towards Sub-Saharan Africa, even if the influx are concentrated in the energy sector.

Elsewhere, it is realized from our analysis that there exists a significant and positive effect between FDI influx into the countries of EMCCA taken as an economic entity (regression model), whereas taken individually by the granger causal analysis, this link does not exist in any country. Contrarily, for a causal analysis by the modified Wald method, there exist very well a causality relationship of FDI towards income per capita for Congo, Gabon and Chad. This relationship is symmetrical in Equatorial Guinea where the high income per head attracts foreign investors notably Moroccans in the construction sector, Americans and the French in the petroleum sector. As against, this relation does not exist in Cameroon and in the Republic of Central Africa, countries with less natural resource endowments, therefore receiving less foreign direct investments.

Table 4. Unit root test

Country	Variables	ADF test	Integration order	Stationnarity decision
Cameroon	Log FDI	-6.80204 (0.000000)	I (0)	stationary
	Log IPC	-2.94698 (0.04940)	I (0)	stationary
Gabon	Log FDI	-1.90846 (0.00000)	I (0)	stationary
	Log IPC	-3.96910 (0.00000)	I (0)	Non stationary
Equatorial Guinea	Log FDI	-11.18905 (0.00000)	I (0)	stationary
	Log IPC	-0.98508 (0.9343)	I (1)	Non stationary
Congo	Log FDI	-5.09602 (0.0010)	I (0)	stationary
	Log IPC	-1.40450 (0.8435)	I (1)	Non stationary
RCA	Log FDI	-5.01448 (0.00000)	I (0)	stationary
	Log IPC	-1.77570 (0.3865)	I (1)	Non stationary
Chad	Log FDI	-2.44623 (0.1364)	I (0)	stationary
	Log IPC	-2.04 (0.56)	I (1)	Non stationary

Table 5. Joyansen's Co-integration test

Country	Hypotheses Present of co-integration)	Integration order of VAR	Trace test	Critical value at 5%	Probability*
Cameroon	0	1	22.18255	15.49471	0.0042
	>1	1	6.582952	3.841466	0.0103
Gabon	0	1	36.66777	15.49471	0.0000
	> 1	1	5.332530	3.841466	0.0209
Equatorial	0	1	14.01568	15.49471	0.0825

Guinea	>1	1	0.788844	3.841466	0.3744
Congo	0	1	10.84927	15.49471	0.2209
	>1	1	1.086261	3.841466	0.2973
RCA	0	1	19.68849	0.0373	0.0110
	>1	1	4.336170	3.841466	0.0373
Chad	0	1	10.84927	15.49471	0.2209
	>1	1	1.086261		0.2973

*MacKinnon-Haug-Michelis (1999) p-values

Table 6. Joyansen's co-integration test

Pays	Hypotheses	Integration order of the VAR	**Max-eigen statistics**	Critical value at 5%	Probability*
Cameroon	0	1	15.59960	14.26460	0.0306
	> 1	1	6.582952	3.841466	0.0103
Gabon	0	1	31.33524	14.26460	0.0000
	> 1	1	5.332530	3.841466	0.0209
Equatorial Guinea	0	1	13.22683	14.26460	0.0724
	> 1	1	0.788844	3.841466	0.3744
Congo	0	1	9.763007	14.26460	0.2280
	> 1	1	1.086261	3.841466	0.2973
RCA	0	1	15.35232	14.26460	0.0335
	> 1	1	4.336170	3.841466	0.0373
Chad	0	1	9.763007	14.26460	0.2280
	> 1	1	1.086261	3.841466	0.2973

*MacKinnon-Haug-Michelis (1999) p-values

Table 7. Granger causality test

VAR Granger Causality/Block Exogeneity Wald Tests							
Date: 19/08/11 Time: 08:05							
Sample: 139 ; Included observations: 37							
Cameroon							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOGIPC)			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D (LOGIPC)	0.000738	1	0.9783	D (LOGIPC)	0.834919	1	0.3609
All	0.000738	1	0.9783	All	0.834919	1	0.3609
Gabon							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOGIPC)			
Excluded	Chi-sq	df	Prob.	Ecluded	Chi-sq	df	Prob.
D (LOGIPC)	0.007384	1	0.9315	D (LOGIPC)	0.009583	1	0.9220
All	0.007384	1	0.9315	All	0.009583	1	0.9220
VEC Granger Causality/Block Exogeneity Wald Tests							
Date: 19/08/11 Time: 08:05							
Sample: 1 39 ; Included observations: 37							

Equatorial Guinea							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOGIPC)			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D (LOGIPC)	0.001151	1	0.9729	D (LOGIPC)	0.146140	1	0.7023
All	0.001151	1	0.9729	All	0.146140	1	0.7023
Congo							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOGIPC)			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D (LOGIPC)	0.301811	1	0.5827	D (LOGIPC)	0.374412	1	0.5406
All	0.301811	1	0.5827	All	0.374412	1	0.5406
RCA							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOG IPC)			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D (LOGIPC)	0.354726	1	0.5514	D (LOGIPC)	1.69E-05	1	0.9967
All	0.354726	1	0.5514	All	1.69E-05	1	0.9967
Chad							
Dependent variable: D (LOGFDI)				Dependent variable: D (LOGIPC)			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D (LOGIPC)	0.301811	1	0.5827	D (LOGIPC)	0.374412	1	0.5406
All	0.301811	1	0.5827	All	0.374412	1	0.5406

Table 8. MWaLD modified causality test (Toda-Yamamato Dolado-Lutkepohl)

MWald VAR Granger Causality/Block Exogeneity Wald Tests							
Date: 19/08/11 Time: 08:05							
Sample: 139; Included observations: 37							
Cameroon							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LOGIPC	1.707585	1	0.4258	LOGIPC	0.774141	1	0.6790
All	1.707585	1	0.4258	All	0.774141	1	0.6790
Gabon							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LOGIPC	1.801705	1	0.1795	LOGIPC	3.196466	1	0.0738
All	1.801705	1	0.1795	All	3.196466	1	0.0738
Equatorial Guinea							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LOGIPC	7.066108	1	0.0079	LOGIPC	4.531314	1	0.0333
All	7.066108	1	0.0079	All	4.531314	1	0.0333
Congo							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LOGIPC	0.057741	1	0.8101	LOGIPC	7.273084	1	0.0070
All	0.057741	1	0.8101	All	7.273084	1	0.0070

RCA							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	x	Chi-sq	df	Prob.
LOGIPC	0.161804	1	0.6875	LOGIPC	0.520592	1	0.4706
All	0.161804	1	0.6875	All	0.520592	1	0.4706
Chad							
Dependent variable: LOGFDI				Dependent variable: LOGIPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LOGIPC	0.057741	1	0.8101	LOGIPC	7.273084	1	0.0070
All	0.057741	1	0.8101	All	7.273084	1	0.0070

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