Neighbourhood Effects and FDI Location: the Role of the Ability to Source Inputs

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Abstract

This paper aims to show, in the African context, that the ability to source inputs from neighbouring countries increases the attractiveness of African countries. Using a methodology based on spatial econometrics, the SLX and SDEM models are applied to a panel of 24 African countries over the period 2004–2015. It appears that the location of FDI in a country is affected by the capacity of its neighbours to provide inputs, particularly in terms of natural resources and economic openness. Moreover, domestic supply chains also affect the location of FDI

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1. Introduction

The analysis of FDI flows shows that the attractiveness of countries towards FDI is strongly influenced by the level of insertion in global value chains (GVCs). However, the world seems to have three interconnected production centres for the vast trade in parts and components: the first centred on the United States, the second on Asia (led by China, Japan and the Republic of Korea), and the third on Europe (especially Germany). About 85% of value added trade in global value chains takes place within the three platforms Asia, Europe and North America. At the same time, according to UNCTAD (2016), Asia, North America and Europe, which are the regions where global value chains are concentrated, received 25.4%, 24.4% and 30.5% of FDI respectively.

As regards Africa, the most integrated economies in the GVC are South Africa, Algeria and Nigeria. According to UNCTAD (2013), in 2012 alone, these three countries had almost \$200 million of value added integrated into products. It should be pointed out that the sub regions of origin of these three countries are those in which intra-regional trade is the highest with 14.2% for SADC (Southern Africa Development Community), 9.33% for ECOWAS and 4% for AMU against 1.79% for CEMAC. At the same time, FDI seems to follow the same pattern. Over the period 1995–2015, the most attractive regions are respectively Southern Africa, North Africa and South Africa with respectively 39%, 25% and 19% of FDI inflows (UNCTAD, 2019).

Two currents of thought seem to structure the analysis of the determinants of the choice of location by multinational firms (MNC). The first trend, which is part of the international economy, considers that MNC choose the location of their investments abroad on the basis of the characteristics of the host sites. The second approach, which is based on the geographical economy, is based on the concept of proximity. It considers that firms choose locations so as to benefit from the network externalities linked to the geographical concentration of business activities. Moreover, for Blonigen et al (2007) there is a spatial dependence between neighbouring countries with regard to the choice of FDI location. Consequently, the attractiveness of a country also depends on that of its neighbours. However, the literature remains silent on the exogenous characteristics of the countries which may affect the location of FDI in neighbouring countries.

With the increasing fragmentation of the production process, a country's ability to provide the inputs needed to produce goods can affect the attractiveness of neighbouring countries. In this regard, Jones et al (1990) point out that this organization of production imposes certain constraints on MNFs to be profitable. Indeed, the distance from the main poles of the value chains implies for a multinational firm higher costs for the search for suppliers and the control of activities.

Therefore, the objective of this paper is to show that the ability to source inputs from neighbouring countries increases the attractiveness of African countries. This work is of twofold interest: on the one hand, it highlights the role of neighbourhood effects in the location of FDI and, on the other hand, it sheds light on the exogenous characteristics of countries that can affect the location of FDI in neighbouring countries.

To achieve the above-mentioned objective, we will mobilize the empirical framework of spatial econometrics on a panel of 24 countries over the period 2005–2014. The rest of this article is divided into 4 points. Section 2 presents a review of the literature. Section 3 describes the methodology and presents the data used. The results and their analysis are the subject of Sect. 4 and Sect. 5 concludes.

2. Literature Review

Increasing global competition and profitability constraints have led multinational firms to opt for an international division of labour within the manufacturing processes of final goods. In this context, the various tasks associated with the production of a good are distributed among countries according to comparative advantages, so as to minimize production costs. In this respect, for vertical specialization to be profitable, it is necessary to bring together the various dispersed components at lower cost. Deardorff (2001) points out that the international fragmentation of the production process can only be implemented if the costs of co-ordinating globally dispersed activities are sufficiently low. Bagchi et al (2013) point out that a supply environment, which incorporates factors affecting transaction efficiency, would have a positive impact on the location decision of multinationals. Factors such as supply chains, openness of economies and natural resource endowment appear to be determinants.

According to Kogut and Zander (1995), if comparative advantages are the ultimate driver of FDI, sites offering lower costs for knowledge transfer and operations management should be favoured. Indeed, a quality supply chain can be seen as a source of improved transaction efficiency through competitive prices and better product quality as demonstrated by Kogut and Zander (1993). Supply chains are therefore a prerequisite for networking and the development of international business strategies.

The work of Vijayakumar (2010) rather highlights the role of the degree of openness of economies in their attractiveness. According to this author, countries that receive lower FDI inflows would be more attractive if they implemented reforms that liberalize their economies. This constraint is all the more important for landlocked countries that depend on their neighbours with coastlines to source parts and components from other continents. Indeed, as Raballand (2003) shows, the landlocked countries already bear transport costs in the framework of the supply of inputs, which could affect their attractiveness.

In the same logic, in order to reduce input supply costs, a multinational firm may wish to locate near countries that have the raw materials it needs. Thus, Asiedu (2006) establishes a positive and significant relationship between abundant natural resources and the total volume of foreign capital inflows. Indeed, companies or countries that want access to natural resources are likely to invest in countries where these assets are abundant.

To conclude with these elements of coordination cost reduction, it is worth mentioning the work of Gibbons et al (2015), which shows that the spatial location of an economic agent can be an additional source of information in order to understand and explain phenomena when there are interactions between agents. This deterministic aspect of the spatial dimension somehow explains the concentration of firms, and hence their performance.

Proximity plays an important role in reducing the costs of coordinating dispersed activities through marshallian externalities. These are positive externalities, which are complemented and intensified by the close links between suppliers and customers co-located in what Porter (1998) calls vertical agglomerations; that is, spatial agglomerations of firms with upstream or downstream links with other firms in the same region. In this respect, Bobonis and Shatz (2007) show that multinationals with vertical production links tend to agglomerate regionally within a country. According to Dyer (1996), supplier networks are a source of competitive advantage, given their supposed complementarity. On this point and according to Sanders and Premus (2002), 53% of American firms subcontract their secondary activities.

For Duranton and Puga (2004), producers of goods benefit from being close to many suppliers and large markets for intermediate inputs. These authors identify four advantages of proximity to suppliers: it increases the availability and variety of inputs, it reduces the average cost of purchase, it reduces any procurement problems in the event of hold-ups between upstream and downstream firms, and it generates learning and knowledge spillovers. These benefits led Alfaro et al (2014) to find that agglomeration economies play a more important role in the agglomeration of multinationals than in the agglomeration of domestic firms.

3. Methodology

The methodological approach is based on three points: the choice of the model and its justification, the estimation method and the data used.

3.1 The Model choice

In this article, the methodological approach is based on spatial econometrics. Indeed, the strong regional concentration of FDI mentioned above implies the existence of spatial dependence. In this context, it can be considered that the characteristics of neighbouring countries can affect the attractiveness of the domestic country. So far, however, with the exception of (Das, 2007), very few studies have taken into consideration the role of neighbourhood effects on the location of FDI, particularly in Africa.

It must be said that if this spatial dependence is ignored, econometric problems will result, as each observation is partially predictable from observations on neighbouring countries, which is similar to autocorrelation in time series data. Anselin (2003) shows that the consequences of ignoring spatial dependence depend on whether the correct model is a spatial lag or a spatial error model. Excluding a spatially lagged dependent variable is equivalent to an omitted variable error and leads to biased and inconsistent parameters.

According to Elhorst (2014), three different types of spatial interaction effects can be considered. The first is an endogenous interaction effect, which considers that the dependent variable of unit i affects the dependent variable of the other units j ($j \neq i$) and vice versa. The second is an exogenous interaction effect in the sense that the explained variable of unit i depends on the explanatory variables of the other units j ($j \neq i$).

Finally, an interaction effect between the error terms may occur, indicating that units may behave in the same way because they share the same unobserved characteristics or face similar unobserved environments.

This leads to the specification of the general spatial model below:

$$Y_{it} = \delta WY_{it} + X_{it}\beta + WX_{it}\theta + u_t \quad \text{With} \quad u = \lambda Wu + \varepsilon \quad (1)$$

Where : Y_{it} is the vector of the endogenous variable ; W is the matrix of spatial weights, X is the matrix of exogenous variables ; u_t the term error et $\delta, \beta, \theta, \lambda$ are the parameters.

According to LeSage (2014) the choice of the specification to be retained depends on the nature of the spillover effects, which can be global or local. Global spill-over effects occur when a change in X of any spatial unit is transmitted to all other units even if the two units are not connected. In contrast, local spill-over effects are those that affect other units only if, according to W , they are connected. This assumes that the coefficient of WY is equal to zero ($\delta = 0$) and that the coefficients of WX are non-zero ($\theta \neq 0$).

However, as mentioned above, the organisation of value chains is regional. Thus, minimising coordination costs implies sourcing locally, which suggests local spillover effects. Consequently, two types of modelling are conceivable, namely the spatial shift of X (SLX) on the one hand, where the exogenous variable of a country affects the performance of its neighbour, and the SDEM models on the other hand, where the exogenous variables of a country and the unobservable characteristics of this country jointly affect the performance of its neighbours.

By considering this relationship and the determinants that recur in the literature, several explanatory variables are considered in this study. The first is the stability of the economy as measured by the inflation rate (STA) and GDP per capita (GDP.H) and the growth rate (GRO).

The size of the economy appears in the literature as a determinant of the location of FDI both in considering market research strategies and the work of the new geographical economy. Several indicators are envisaged for the size of the market including the size of the population as Mohamed and Sidiropoulos (2010) did for the case of MENA countries or the GDP according to the approach of Asiedu (2006).

As established by Dunning's (1979) eclectic theory, countries that are endowed with natural resources (NRES) receive more FDI. The omission of a natural resource variable in the estimation, particularly for African countries, may cause estimation bias as many studies, including that of Asiedu (2006), show that FDI to African countries is more oriented towards the natural resource sector.

The openness of the economy (OPE) is measured by the ratio of imports to GDP. This ratio is often interpreted as the quantification of trade restrictions. In general, the impact of trade openness is related to the type of foreign investment. Indeed, the existence of many trade restrictions favours the entry of horizontal FDI. Whereas multinationals engaged in vertical export activities or FDI, prefer to invest in relatively open economies because trade barriers increase transaction costs.

Human capital (HC) is an important factor in attracting FDI. The quality of the workforce reassures foreign investors of the capacity to assimilate the new technologies which accompany FDI. The more qualified the local labour force is, the lower the labour costs will be, as foreign expertise is reduced, thus increasing the profitability of investments.

According to Acemoglu (2005) investors are reluctant to invest in countries where expropriation and other types of private property violation are common for fear of losing their investments. The GCI's property rights indicator (LAW) and the WGI's (INS).

Furthermore, with reference to Martínez-Galán and Fontoura (2018), which show that participation in global value chains increases the volume of FDI received by a country, we include in our analysis an index of VVC participation. It is measured by the foreign value added in a country's exports (FVA). The same applies to supply chains (SC). Indeed, the increasing fragmentation of production requires the reduction of the costs of coordinating dispersed activities. To do this, countries need to have quality supply chains. The work of Alam et al (2013) and Bagchi et al (2014) reinforces this presumption.

3.2 Sample and data sources

The sample selected for this study is composed of 24 African countries over the period 2005–2014. This choice is constrained by the availability of data on certain variables. The World Economic Forum database available since 2005 has enabled us to construct a synthetic indicator of the quality of supply chains. Following Bagchi et al (2014), three components enter into the evaluation of supply chains: infrastructure, the supply environment and the absorption capacity of the country's enterprises. In our study, the supply environment alone comprises four components: the sophistication of the buyer, the quantity of local suppliers, the quality of local suppliers, and the local availability of components and

parts from the Global Competitiveness Report, published annually by the World Economic Forum. Finally, the quality of supply chains is an average of the six variables above.

Three other databases were used. First, the World Development Indicator (WDI) which provided nominal GDP data to capture the size of economies and the rate of inflation that serves as a proxy for economic stability. Second, the same database was used to calculate the share of mineral and fuel exports in total exports and the openness rate of economies, providing data on exports, imports and GDP. Then the use of the Penn World Table 9 (PWT.9) provided data on human capital. This database provides a human capital index based on years of schooling and returns to education. In addition, we used the joint UNCTAD and EORA database to assess involvement in global value chains. This variable is approximated by the share of foreign value added in a country's exports.

There are three main approaches to the construction of the spatial weight matrix. The first one assigns weights as a function of the distance between the different agents. The second one considers the limits shared between the spatial units. The weights attributed to each agent are thus a function of whether or not these different units share common boundaries. The last approach is that of normalisation of spatial weights, which is a mixed approach of weight attribution, combining the approach by distance with that of borders. Because of the object of the study, the construction of the matrix of spatial weights follows the second approach. Thus, the value 1 is assigned to neighbouring countries, while countries that are not neighbouring receive a value of 0.

3.3 Estimation method

The use of a regression model with a temporal dimension requires the need to ensure beforehand that each series involved in the modelling has good properties (stationarity), in order to guarantee an unbiased inference. In view of the evidence provided by the results of this table (appendix 4), we can conclude that all the variables are stationary, as both tests lead to the same conclusions ($pvalue < 5\%$).

Furthermore, the correlation matrix shows that of all the explanatory variables, only TAIL and FVA are more than 50% correlated to the FDI variable. However, some explanatory variables are correlated with each other: SIZ-OPE (-51%), INS-LAW (70%), INS-SC (64%), HC-GDP.H (68%), FVA-GDP.H (61%), FVA-SC (51%), GDP.H-SC (60%) (appendix 3). As these are simple linear correlations, their values may increase in a spatial panel data model due to the presence of the spatial weight matrix and individual fixed effects. However, the signs of the correlations of the explanatory variables with the FDI variable are expected to be of the same sign as the FDI variable at the end of the modelling (at least for the variables having a strong linear correlation with the FDI variable). Also, for the purposes of improving the quality of the model, our choice of excluding certain variables will be based on their insignificance and their strong linear correlation with another explanatory variable, in order to avoid the phenomenon of multicollinearity.

As far as the estimation method is concerned, different approaches are possible, but with reference to Elhorst (2014) the maximum likelihood estimator and GMMs are the most suitable. Indeed, they have the advantage of not being based on the assumption of disturbance normality. However, in the presence of

spatial autocorrelation and given the fact that there is a linear correlation between certain variables, the GMM method is the most appropriate.

Hausman tests of fixed versus random effect are performed on both Durbin spatial panel models with spatial delay for the dependent variable and errors (SDEM), estimated by maximum likelihood, allows to conclude almost with certainty, that the random effect model is the most appropriate (pvalue close to 1) in case of spatial effect.

The LM-H test, whose alternative is the hypothesis of a random-effect model with spatial autocorrelation, leads to the conclusion that the most suitable model is the random-effect model with spatial autocorrelation (pvalue = $2.2 \times 10^{-16} < 5\%$).

4. Results

In the table of results, some precisions are necessary: sp in front of a variable indicates that it is its spatial delay. Rho designates the spatial autocorrelation parameter of the errors, lambda the spatial delay parameter of the explained variable. σ^2_v , σ^2_1 , theta are parameters related to the structure of the variance of the errors. The last 4 lines of the table present the values estimated by iterative calculation of the parameters related to the residuals.

After estimation by the maximum likelihood method (ML), the parameter phi being significant, there is a significant spatial autocorrelation, even if rho and lambda are not significant. The second column of the table presents the results by the GMM method on all the variables for a SDEM model. The lambda coefficient is significant for this model. In other words, there are neighbourhood effects in the location of FDI in Africa.

Furthermore, using the RMSE (Root Mean Square Error) comparison criterion, we find that the best model is the SDEM (RMSE = 0.02 versus 1.01). After finding on the correlation of SIZ_sp and OPE_sp, we also exclude the variable SIZ_sp from our model, since it is not significant. This makes it possible to increase the level of significance for certain variables and to further reduce the standard deviation of the errors. The model used is therefore the one in the last column.

The results show that neighbourhood effects appear mainly for factors that affect the availability of inputs in neighbouring countries. Indeed, the positive impact of the rate of openness on the location of FDI in neighbouring countries can be explained by the fact that the trade of landlocked countries with the outside world, particularly in terms of acquisition of parts and components or exports of finished products, passes through neighbouring countries which have a seafront. Moreover, the proximity of a country with the natural resources which go into the manufacture of the goods of a multinational firm helps to reduce the costs of supply while benefiting from other characteristics which the neighbouring country with natural resources does not have, such as a large market (SIZ) with consumers with a high purchasing power (GDP/H).

However, the increase in human capital, both at the national and sub-regional levels, has a negative effect on the attractiveness of the domestic country. This result runs counter to the existing literature, in particular the work of Cleeve (2008) which supports the opposite thesis. This can be explained by the fact that the increase in human capital is associated with an increase in the level of wages. However, in the context of the fragmentation of production, firms generally relocate their manufacturing activities to low-wage countries in the South, while design, research and development activities remain in the North.

Moreover, the results show the importance of national supply chains in the location of FDI. These results are in line with those of Bagchi et al (2014) which showed that supply chains are a determinant of FDI location. However, the supply chains of neighbouring countries do not have a positive impact on the performance of the domestic country in terms of attractiveness. This can be explained by the low level of trade between African countries, already castigated by the World Bank (2017), which reports a low level of regional integration in Africa, since less than 25% of trade is carried out between countries in the area. In this context, the multinational firms that set up in this continent can supply very few parts and components to their neighbours.

5. Conclusion

The purpose of this paper was to show that the ability to source inputs from neighbouring countries increases the attractiveness of African countries to FDI. The estimation of a spatial panel through the SLX and SDEM models has shown that the factors that influence the capacity of firms in production factors also have an impact on the attractiveness of their neighbours. More precisely, the rate of openness of the economy as well as its endowment in natural resources have an impact on the location of FDI in neighbouring countries. However, the availability of supply chains does not seem to have any effect on the performance of neighbouring countries in terms of FDI location.

In this respect, improving the attractiveness of African economies requires increased cooperation at the sub-regional level. Indeed, the reduction of coordination costs and consequently the improvement of regional attractiveness can be achieved through the implementation of a common industrial policy that aims to improve the supply environment so as to strengthen the links between producers and consumers. This will involve identifying the sectors in which the country has a comparative advantage and implementing incentive policies to guide both national and foreign investment in this sector. In addition, investments in transport and communication infrastructure in the subregion will finish improving the supply chain to minimize the costs of multinational firms setting up in the host country. Finally, it appears essential to develop national and sub-regional industry through scientific and technical discoveries by financing research and development.

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Table

Table : Summary of the different estimates used to choose the best model

	Estimation ML SLX	Estimation GMM SDEM (ALL var)	Estimation GMM SLX	Estimation GMM SDEM
Phi	0,85 (2,342)*			
Rho	-0,01 (-0,038)			
Lambda	-0,06 (-0,461)	-0,345 (-2,549)*	-0,082 (-0,464)	-0,45 (-4,373)***
(Intercept)	22,311 (31,086)***	28,332 (9,645)***	22,3 (6,048)***	30,071 (12,814)***
pib.h	0,044 (2,692)**	0,046 (3,404)***	0,043 (2,543)**	0,045 (3,419)***
OPE	0,15 (4,327)***	0,151 (4,896)***	0,153 (4,248)***	0,152 (4,787)***
STA	-0,052 (-0,92)	-0,044 (-0,811)		
SIZ	0,078 (5,666)***	0,066 (6,358)***	0,079 (5,205) ***	0,066 (6,029)***
NRES	0,132 (2,695)**	0,163 (3,924)***	0,139 (2,653)**	0,177 (4,294)***
INS	-0,008 (-0,159)	-0,019 (-0,451)		
HC	-0,118 (-1,176)	-0,215 (-2,774)**	-0,114 (-1,024)	-0,219 (-2,771)**
SC	0,049 (2,497)*	0,057 (3,345)***	0,048 (2,395)*	0,055 (3,159)**
gdp.h_sp	0,019 (0,816)	0,037 (1,872).	0,016 (0,635)	0,04 (1,959).
OPE_sp	0,067 (1,304)	0,132 (2,546)*	0,072 (1,261)	0,141 (2,811)**
STA_sp	-0,024 (-0,335)	-0,017 (-0,24)		
SIZ_sp	-0,027 (-1,58)	-0,014 (-0,844)	-0,023 (-0,966)	
NRES_sp	0,168 (3,087)**	0,239 (4,698)***	0,172 (2,97)**	0,237 (4,546)***
INS_sp	-0,11 (-1,266)	-0,12 (-1,626)	-0,106 (-1,143)	-0,088 (-1,298)
HC_sp	-0,325 (-1,978)*	-0,518 (-4,116)***	-0,286 (-1,627)	-0,489 (-3,665)***
SC_sp	0,005 (0,203)	0,034 (1,393)	0,005 (0,169)	0,035 (1,412)
Rho (par calcul itératif)		0,222		0,266
sigma^2_v		0,003		0,003
sigma^2_1		0,013		0,016
theta		0,497		0,546

Level of significance : ***1%; ** 5%; * 10%.

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