Where and Why Do Chinese and U.S Firms Invest in Africa: Application of A Spatial Analysis using FDI inflows

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Abstract

In an attempt to expand the manufacturing sector, several African countries have been providing incentives to attract foreign investors. Some Chinese and U.S firms have responded to these incentives by have investing in several African countries. However, not all African countries received a big influx of Chinese and U.S investments. Anecdotes and some descriptive statistics suggest that host country natural resource endowment and market potential are among the factors that may have influenced the location choice of Chinese and U.S. firms, respectively, within Africa. In increasingly integrated global, regional, and local markets, interconnectedness or neighboring countries is also another key factor affecting location decisions. This has manifested in the form of agglomeration or congestion effects as well as cost of production differentials across countries. Using Chinese and U.S overseas investment data, this study presents empirical evidence on how neighboring countries are important, in addition to traditional determinants, in attracting FDI to a host country. Our findings show that there is evidence of spatial interdependence for Chinese and U.S. FDI flows to African countries. For investment from both countries the third country effect comes through explanatory variables (including market size, trade cost, share of wage workers, access to electricity, and share of service sector), although there is stronger evidence for the case of U.S than Chinese FDI. Unlike previous studies, the effect of the spatial lag effect losses its significance when other factors are controlled for the third country effects. Overall, there is evidence that, unlike Chinese FDI, U.S FDI seem to be market-seeking and takes into account neighboring countries' economic situation to invest in in a host country.

Keywords: China, Africa, Agglomeration, Spatial Correlation
JEL Classifications: D22, F23

I. Introduction

Industrialization is the top priority for many developing countries and more so for countries in Africa whose economic performances fluctuate with booms and busts of commodity prices. Achieving industrialization is, however, not an easy task and in fact, several African countries have attempted this since the 1960s. In recent years there is a sign of hope as both domestic and foreign investors show some interest in investing in the manufacturing sector through Greenfield Investments, as well as mergers and acquisitions.

Most of these foreign firms saw opportunities in the African markets to tap into advantages that they believe African countries offer, including markets, production cost advantages, as well as proximity to industrial inputs. Although cheap labor is one of the attractions often reported in the news, access to input/resource, and cheap land have proven equally important. On top of these cost/input/market advantages, locating in a city where other firms have already located and where networks of infrastructure are easily accessible have the added potential benefit through agglomeration economies. Some of these firms have relocated from other emerging countries in Asia or Europe to Africa hoping to cash in these advantages. At the same time, the rising cost of congestion in emerging Asian economies (location of "factories of the world" in recent decades) seem to serve as a push factor. For cost-benefit analysis of location choice firms often look into these potential agglomeration effects and the associated cost of congestion. The present study attempts to address the potential impacts of these factors in influencing location decisions in the context of African countries using Chinese and US Foreign Direct Investment (FDI) data. Instead of location choice within a country, the present study focuses on cross-country agglomeration and congestion effects as well as other factors that influence location choices of the inflow of FDI.

The discussion on agglomeration economies and the cost of congestion is not new; beginning with Alfred Marshall (1890) observation of the existence of economies of scale in industrial clusters and fast forward to Paul Krugman's (1991a) seminal work on economic geography, the issue proved relevant and expanded to several areas, albeit at a slower pace (Iammarino & McCann, 2013). Cohen et al. (2005) presented a theoretical context and highlighted the channel through which spillover effects operate to influence investment location decisions.

For African countries, it may seem too early to discuss the benefits of agglomeration economies and the costs of congestion as the continent just started to receive foreign investors. However, even the limited inflow of investors often chose locations in capital cities and a couple of other major cities where they have access to infrastructure and other business services. As investors make back-of-the-envelope calculations to make optimal location decisions, these cities remain the only viable locations. In response, several African countries have begun expanding infrastructure networks into less crowded place hoping to spread foreign investments and also incentivize investment in the continents priority sectors like agriculture. In addition to the traditional location choice determinants, neighboring countries' characteristics have become an important factor. This has been highlighted by the fact that in recent decades the level of integration among countries has increased significantly. The increased flow of trade, capital, and labor across (neighboring) countries is a testament to this assertion. It is often argued that since African countries infrastructure network is not well developed, and trade and investment ties within the continent is limited, one may not expect that FDI would be spatially correlated. However, given the developments in recent decades and global trade and investment attentions that African countries have received, whether interconnectedness has the expected impact in affecting location decisions of foreign investors in general and for the Chinese and U.S. FDIs in Africa, in particular, remains an empirical question.

In this study we tracked thirty nine African countries overtime and make some attempts to address the following questions:

1. What key factors influence Chinese and U.S firms' investment location decision in African countries?
2. Apart from the traditional location choice determinants, is there any effect from spatial interdependence (or a third country effect) that influence location decision of a firm in a host country?
3. What are the channels through which spatial interdependence manifests itself?, Which model has the largest impact?

The remaining part of the study is organized as follows. The next section presents literature review. Section three discusses methodology and data that we employed in this study. The fourth section

presents the results and discussion of the findings in relation to previous studies. The final section concludes the study.

II. Literature Review

The relevant literature to explain motivations of foreign investors mostly revolves around host and home country characteristics as well as firm-specific attributes. Three strands of the literature present alternative explanations (Nielsen, et. al., 2017; Kim & Aguilera, 2016). The first strand posits that foreign investors look for markets in a host country and hence they engage in horizontal FDI. The second strand puts vertical integration (input sourcing) as a primary motive where firms aim to source production inputs to take advantage of a headquarter's assets to generate highest possible returns given host country local conditions. The third stand is the knowledge-capital model (henceforth KK model) that aims to provide a generalized model for the above two motives (Markusen & Maskus, 2002). Dunning (1980)'s eclectic paradigm is also an attempt to capture the motives of FDI using an alternative framework labelled OLI (Ownership-Location-Internalization) advantages. A firm that owns an intangible asset may choose a location that suites a firm to generate maximum return by internalizing the operation in a host country. Melitz (2003) added firm-level productivity as an additional necessary condition for a firm to go global as FDI.

Nielsen, et al. (2017) summarizes the traditional destination location characteristics (both pure-economic and business strategic) that affect location choice decision by an FDI under four major groups. These are pure economic factors, including tax, infrastructure, human capital and wage; institutional factors, including rule of law, regulation and government stability; intra- and inter-industry agglomeration and industrial clusters; and finally, parent firm-characteristics, including ownership of superior technology, international experience, among others. The variables listed in the first two groups can be accounted for in a country-level study like the present study; though accounting for firm characteristics needs firms level data. The previous studies followed this line of literature to estimate the traditional FDI determinant models (Chang, 2014; Ramasamy et al., 2012; Amighini et al., 2013; Seyoum and Lin, 2015). Ramasamy et al. (2012) and Amighini et. al. (2013) examined the motivations of Chinese FDI in choosing a host country, they grouped the firms into state-owned vs. private firms. Their results show that state-owned firms seek resources where as private firms seek market in a host country. Seyoum and Lin (2015) looked at Chinese private firms in Ethiopia and

found that Chinese FDIs seek market access to take advantage of parent firm's asset in Ethiopia. Again, there is no explicit discussion about the role of third country effect as one of the determinants of location decision.

Recently, several studies argue that there is one dimension that the above three models ignore because of the fact they build their models on a two-country world without reference to effects from a third country. Considering a third country in such models brings additional motivations for FDI to invest in a host country, among them are the market potential and resource availability of a neighboring country, and access to roads or ports through a third country. The idea behind a third country effect as it regards to regional integration is that a firm may have a plan to use a host country as an export platform to reach another country market. That makes the economic size of the third country as important as the characteristics of a host country. Spatial analysis is methodology that makes an attempt to fill this gap by including a third country as part of location choice determinant (Baltagi, et al., 2007). There are several studies that undertake spatial analysis similar to ours (Baltagi, et al., 2007; Blonigen et al., 2007; Nwaogu & Ryan (2015); Chang, 2014; Chou et al., 2011; Ramasamy et al., 2012; Amighini et al., 2013). Only one of these studies looked at the case of FDI flow to Africa (Nwaogu & Ryan, 2015).

Baltagi et al. (2007) used distance-weighted variables to estimate a spatial model. They argue that studies that don't include such variables (or ignore spatial interdependence) suffer from omitted variable bias. Using U.S. FDI data to 51 host countries, their results show that the distance-weighted variables are significant in explaining variations in FDI. Blonigen et al. (2007) and Nwaogu & Ryan (2015) found support for distance-weighted variables as well as the traditional location determinant variables. Both studies, using U.S outbound FDI, show that traditional determinants of FDI remain robust even after including terms to capture spatial dependence.

Similar studies (Chou et al., 2012; Chang et al., 2014) confirm the presence and importance of spatial interdependence in their analysis for the case of Chinese FDI. Using Chinese FDI data, Chou et. al. (2011) show evidence of third country effect using both spatial lag and spatial error models. Their findings show that there is positive and significant impact for the spatial lag and spatial error specifications, though their results don't confirm presence of third country market potential as a motivating factor for Chinese FDI. The positive and significant coefficient on the spatial lag variable

confirms that Chinese FDI investment in a host country is affected by Chinese FDI in neighboring countries. This is consistent with results that Baltagi, et al. (2007) and Blonigen et al. (2007) reported. However, distance-weighted market potential variable has negative and insignificant variable, which implies that market potential of a third country doesn't seem to be the main motivating factor for Chinese FDI. Host country market size (i.e. GDP) is reported to have no effect to attract Chinese FDI. Since their study looked into Chinese FDI in sample countries from Asia, Africa, Europe, Latin America and North America, it is not comparable to the present study.

A similar study looked for the presence of spatial dependence for Chinese FDI in 138 countries around the world between 2003 and 2009 (Chang et al., 2014). Contrary to Chou et al. (2011), they found that evidence of third country effect (spatial interdependence) through SMP (surrounding market potential) indicator. That is, Chinese firms invest in developing countries motivated by market potential of surrounding the host developing countries and to use a (petroleum exporting) host country as an export platform to reach surrounding markets.

Nwaogu & Ryan (2015)'s study is the one that closely relate to ours. They looked for a presence of spatial dependence for the case of U.S FDI in Africa and Latin America and the Caribbean (LAC) and motivations of foreign investors in these continents. Employing US FDI outbound data into 37 African host countries from 1995-2007 and distance-weighted spatial matrix, they run a spatial autoregressive (SAR) model controlling for spatial fixed effects. They also confirm presence of spatial interdependence but show that traditional determinants also remain important even after accounting for spatial dependence or cross-sectional correlation. Specifically, their findings show that U.S FDI to African and LAC countries is affected by U.S FDI outflows into neighboring host countries. They report that their finding is robust to country and time fixed effects in a panel data setting[1]. Our study goes beyond SAR model and explore two additional spatial model specification to check for robustness of our results. That is, we estimate spatial lag autoregressive, spatial error, spatial lag-explanatory variable and a combination of these specifications. We utilize the likelihood ratio as a model selection for the various specifications in the empirical analysis.

III. Methodology and Data

[1] Similar results are not reported in Blonigen et al. (2007) and contrary to Elhorst's (2010) expectation that the role of spatial effects decline with time.

Spatial data analysis is an econometric estimation technique that takes into account information about a location and its attributes to help identify agglomeration and congestion effects. This technique is a logical fit to do such analysis. Several previous studies have adopted this technique to answer similar research questions for investment locations in China (Cheng and Stough, 2006), as well in Nigeria, and Ethiopia (Owoo and Naud, 2017).

In the location decision literature, the empirical framework assumes that location decisions are independent. The idea is that when a firm decides to locate in country/province/city j it does not take into consideration the characteristics of neighboring countries/provinces/cities. In reality location decisions are not independent, a firm decides to locate in a country/province/city perhaps because there may be similar economic activity, similar cultural practices, expected spillover effects, or complementarity of inputs/outputs from neighboring countries, which makes location decisions interdependent (see Baltagi, Egger and Pfaffermayr, 2007). For example, a firm may decide to locate in country/province j because a neighboring country/province has a better highway accessibility which would reduce transportation cost to reach seaports or airports. Spatial econometrics[2] allows us to incorporate these interdependencies into a regression model which conventional framework lacks. In such setup if a firm makes a location decision in a given country because of the reasons given above, influence from a neighboring country comes through various channels, such as the error terms, the dependent variable, and the explanatory variables. Hence, assuming independency of error terms across countries will no longer be a valid assumption. As mentioned above, highway accessibility, better infrastructure, similar economic activity, agglomeration effects are latent variables. These are important variables that explain location decisions and it seems unlikely that these explanatory variables will be available to be used to capture these unobservable influences. If we believe that these are important variables in explaining location decision, then omitting then would lead to bias and inconsistent estimates.

Additionally, while many previous studies use market access, or horizontal or vertical linkages to measure the proximity of nearby economic activities (see Head and Mayer, 2004), these variables do not capture the third country effects. The amount of FDI going into these countries are jointly determined or co-determined and hence there are feedback effects which are similar to simultaneous

2 A recent JEL article describes that the main task of spatial economics is "to identify the microeconomic underpinnings of centripetal forces, which lead to the concentration of economic activities, and centrifugal forces, which bring about the dispersion of economic activities at the regional and urban levels" (Proost and Thisse, 2019)

equations (see Lesage and Pace, 2009; Anselin, 1988, 2001; and Kelejian and Prucha, 1999). Regressing FDI on just host country market potential or other traditional determinants to explain location decisions of FDI would ignore neighboring countries' effects. Also, it has been known that relatively low labor cost areas are more attractive in luring FDI assuming everything else equal. However, if we use wages to explain location decision without accounting for spillover effects and other spatial interactions it will overestimate the impact of wages on FDI. Similarly, the spillover effects come not only through labor and other input prices in a host country and its neighbors, but also the amount of FDI in a neighboring country that affects the level of spillover and congestion effects. It is, therefore, imperative that the empirical methodology employed in such studies should be able to derive precise estimates by taking into account these spatial spillover effects. Studies that take into account such spillover effects would lead policy-makers to design appropriate policies so that it could help to attract FDI to the more disadvantage countries in Africa, and eventually to reduce regional income disparity and enhance growth. According to Lee (2004) dependence that exists across spatial units is a relevant issue in urban, real estate, regional, public and industrial organization and to capture spatial dependence, the approaches in spatial econometrics are to impose structures on the model in question.

Spatial Analysis Model

The general spatial panel model is given as:

$$y_{it} = \alpha + \rho \sum_{j=1}^{n} W_{ij} y_{it} + \sum_{K=1}^{K} X_{itk} \beta_K + \sum_{K=1}^{K} \sum_{j=1}^{n} W_{ij} X_{jtK} \theta_K + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = \mu_i + v_{it} \quad (2)$$

$$v_{it} = \lambda \sum_{j=1}^{n} M_{ij} v_{jt} + \epsilon_{it} \quad (3)$$

where i=1,…,n and t=1,…,T.

The y_{it} represents the dependent variable for the i_{th} country overtime and x_{itk} is the k_{th} regressors for the i_{th} country overtime, ε_{it} consists of two components, μ_i which represents the time invariant unobserved heterogeneity across countries, and v_{it} is the idiosyncratic components. The term $\sum_{j=1}^{n} w_{ij} y_{jt}$ represents the weighted average of neighboring observations of the dependent variables and this is used to capture interdependencies among the n observations. The term $\sum_{k=1}^{K} \sum_{j=1}^{n} w_{ij} x_{jtk}$ captures the spatial correlation in the regressors and $\sum_{j=1}^{n} M_{ij} v_{jt}$ captures the spatial correlation in the error term. The respective parameters ϱ, θ and λ measure the strength of the spatial correlation.

If =θ =λ=0 the model reduces to the standard panel data where there is no spatial interactions. If θ =λ=0 the general model reduces to Spatial Autoregressive Model (SAR) and if ρ =θ =0 the model reduces to the Spatial Error Model. If λ=0 the general model reduces to the Spatial Durbin Model (SDM), this model nests the SAR model (see Lesage and Pace, 2009). In our derivations below we will assume that λ=0, but we will bring this back in our estimation to show robustness of our results. Generally, the values of ϱ are restricted to lie between minus and plus 1, (-1< ρ <1), see Lesage and Pace (2009).

Using matrix notation to represent equations 1 and 2 and assuming that λ=0, the model becomes,

$$y_{it} = \rho W y_{it} + X_{it}\beta + WX_{it}\theta + \mu_i + v_{it} \quad (4)$$

Where;

y_{nt} =$(y_{1t},\ldots,y_{it})'$ is an n x 1 vector of observations for time period t;

X_{it} is n x k matrix of non-stochastic matrix of time varying regressors for period t;

W is n x n spatial weight matrix

μ_i is an n x 1 vector of individual effects;

v_{it} =$(v_{1t},\ldots, v_{it})'$ is an n x 1 vector of the idiosyncratic error components which are independent and identically distributed across n and t. It has mean zero and constant variance σ_2,

ρ is a scalar, β is a k x 1 and θ is a k x 1 vector of unknown parameters that are to be estimated.

The weighted matrix W is pre-specified and are used to capture economic and physical interdependencies in both the dependent variable and the covariates. It is a non-negative matrix. Two additional assumptions are required to ensure that the estimates are consistent:

Assumption 1. The row and column sums of the matrices W and (I_n - ρ W), before W is row-normalized, should be uniformly bounded in absolute value as n goes to infinity.

Assumption 2. The matrix (I_n- ρ W) is non-singular for all the values of ϱ ∈ ((1/(ρ min)), 1) where ρ min is the smallest eigenvalue of W.

Assumption 3. All the diagonal elements of W equal to zeros.

Note that I_n is an n x n identity matrix. Assumption 1 is imposed to ensure that the cross-sectional correlation is limited to a manageable degree that is the correlation between two spatial units should converge to zero as the distance separating them increases to infinity. Assumption 2 ensures that the y's are uniquely defined while assumption 3 guarantees that there is no interaction or dependence between country i and itself (Kelejian and Prucha, 1998, 1999; and Elhorst, 2014). For panel data the weighted matrix is a block diagonal where each diagonal element represents a single year. The weighted matrix is constant overtime and the weights are exogenously determined. For the present analysis the weighted matrix is given as[3],

$$W=\begin{pmatrix} W_{2000} & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & W_{2017} \end{pmatrix},$$

where for example the submatrix for the year 2000 would be,

$$W_{2000}=\begin{pmatrix} 0 & W_{12} & W_{13} \cdots & W_{1n} \\ \vdots & & 0 & \vdots \\ W_{n1} & & W_{n2} \cdots & 0 \end{pmatrix}.$$

The elements of the matrix are computed using the inverse distant that is $W_{ij}=1/d_{ij}$ where $i \neq j$ and d_{ij} is the physical distance between country i and j.

The Fixed Effect model in equation 4 assumes that there are unobserved heterogeneity and estimated parameters will be correlated with the regressors in the models. Therefore, we cannot use the standard transformation ($J_T = (I_T - \frac{1}{T}(l_T l_T'))$) to wipe out the time invariant heterogeneity (μ_i) since the transformation induces dependence in the error structure.[4] Lee and Yu (2010) used the transformation (F_T , $(\frac{1}{\sqrt{T}})l_T$) for a one way error component model to eliminate the time invariant parameters without inducing dependence in the error component. Accordingly, the matrix F_T is the corresponding matrix based on the orthonormal eigenvector matrix of $J_T = (I_T - \frac{1}{T}(l_T l_T'))$ where I_T is an identity matrix of dimension T and l_T is T x 1 vectors of ones. Using the above transformation (F_T, $(1/(\sqrt{T})l_T)$ the model becomes,

$$y_{nt} = \rho W y_{nt}^* + X_{nt}^* \beta + W X_{nt}^* + v_{nt}^* \quad (5)$$

[3] In the empirical analysis, the weighted matrix is row normalized where the rows sum to unity.

[4] Note that in equation 4 the variable Wy_{it} on the right hand side is correlated with the error term unless the spatial correlation parameter equals zero that is $E(Wy_{it}, v_{it}) \neq 0$. Therefore, standard Fixed Effect or Random Effect models will yield inconsistent estimates.

The variables (y^*) are in mean deviation where the means are computed overtime. The Random Effect Model assumes that the unobserved heterogeneity are random variables and are uncorrelated with the regressors. If this assumption holds, then this model is relatively more efficient than the Fixed Effect Model. We will use the Hausman test to formally choose between these two models.

The Direct and the Indirect (Spillover) Effects

For the standard model (OLS) the marginal effects are partial derivatives of the dependent variable with respect to the independent variable and the cross partials are all zeros. For the SAR and SDM models the interpretation of the parameters include the cross partial derivatives since in the presence of spatial correlation in the dependent and the independent variables they are non-zeros. Therefore, using pooled OLS or the standard fixed effect or random effect models would provide inaccurate inference since these models assume that the cross partials effects are zeros. Rewriting equation (4) and assuming that T=1 for simplicity,

$$Y = (I_n - \rho W)^{-1}(X_{nt}\beta + WX\theta) + (I_n - \rho W)^{-1}\varepsilon \qquad (6)$$

$$\left(\frac{\partial E(Y)}{\partial x1k} \quad \dots \quad \frac{\partial E(Y)}{\partial xnk}\right) = \begin{pmatrix} \frac{\partial E(Y1)}{\partial x1k} & \cdots & 0\frac{\partial E(Y1)}{\partial xnk} \\ \vdots & \ddots & \vdots \\ \frac{\partial E(Yn)}{\partial x1k} & \cdots & \frac{\partial E(Yn)}{\partial xnk} \end{pmatrix} = (I_n - \rho W)^{-1}\begin{pmatrix} \beta_k & w_{12}\theta_k \cdots & w_{1n}\theta_k \\ \vdots & \ddots & \vdots \\ w_{n1}\theta_k & w_{n2}\theta_k \cdots & \beta_k \end{pmatrix} \qquad (7)$$

Note that $(I_n - \rho W)^{-1} = I_n + \rho W + \rho^2 W^2 + \rho^3 W^3 + \rho^4 W^4 + \cdots$

The above $((I_n - \rho W)^{-1})$ converges to a geometric series when the absolute value of the spatial correlation parameter is less than one ($|\rho|<1$), and the weighted matrix (W) is row normalize – the geometric series is only a function of the spatial parameter. From the above we see that country j will not only be affected by its immediate neighbor (ρW) but also by the neighbor of its immediate neighbor ($\rho^2 W^2$) and so forth. There is connectivity of country j amongst its second neighbor and third neighbor ($\rho^2 W^2 + \rho^3 W^3 + \ldots$), respectively, however, these effects decrease for higher order

neighbors since the absolute value of the spatial parameter is less than one ($|\rho|<1$) (see Lesage and Pace, 2009). The elements on the diagonal matrix in equation 7 represent the direct effects and the off diagonal elements are the indirect effects. The direct effect is the impact on a country's dependent variable resulting from a change in an explanatory variable for that country – this interpretation is similar to the standard marginal effects. For example, when the covariate x_k changes, β_k tells by how much country k will be affected while accounting for the feedback effects via the magnitude of the spatial correlation parameter (ρ). The indirect effects are the influences on the dependent variable in country k resulting from a change in the explanatory variable in other (neighboring) countries due to the indirect spatial spillovers effect. The total effect is the sum of the indirect and direct effects (see Lesage and Pace, 2009; Elhorst, 2014; and Golgher and Voss, 2016).[5] These results generalize to panel data since the spatial correlation is constant overtime.

Data

To answer the research questions posed above, we will use U.S. and Chinese FDI outflow for 39 African countries between 2000 and 2017. We obtain Chinese FDI outflow from the China Global Investment Tracker (supplemented by information form the Chinese Ministry of Commerce, MOC), and U.S FDI outflows to African countries from the U.S. Bureau of Economic Analysis (BEA).
We pooled these FDI datasets with datasets that contain host country economic, social, and political characteristics. We gathered information about host country characteristics from the World Bank's World Development Indicator (WDI) database; this is supplemented by host country education statistics from World Bank's Education Statistics at https://datatopics.worldbank.org/education/.
In addition, location coordinates for each host country is retrieved from CEPII (Center for Research and Expertise on the World Economy in France) (Mayer & Zignago, 2011).

1. Following the literature (Neilsen, et al., 2017), we group key regression variables into five categories: economic structure; government regulation (including taxation and political/social stability measures); trade and regional integrations indicators; infrastructure; and labor and skill indictors. For each of the above categories, based on the availability of indicators we have chosen the following proxies. Table 1 in the appendix provides definitions and sources of each

[5] The direct effects are computed by averaging the diagonal elements of the matrix in equation 7 and the indirect effects is measured by averaging either the row sums or the column sums of the off diagonal elements of the matrix in equation 7. According to Elhorst (2014) the numerical magnitudes of calculating the indirect effects (i.e. using either the row sums or the column sums) are the same so it does not matter which one is used.

variable. Economic structure: This matters for foreign investors as they look for composition of a country's economy to decide on which sector to invest. For instance, the mode of entry of a firm partly depends on the market size (GDP) of a country, among other factors. In this study we proxy economic structure/composition with the following indicators: GDP, GDP growth, natural resource rent, availability of domestic credit, share of service sector in GDP, and gross fixed capital formation.

2. Government regulation (including taxation and political/social stability measures): Foreign investors are particularly worry about the role of a government and the regulations that govern foreign firms. It is not just the role of the government but also the stability of the country/government itself is a key factor for foreign investors as they often seek protections and guarantee from a government. We proxy the role of government and business regulation with the follow indicators: Business and other taxes, cost of business start-up, measures of political stability, and quality of business regulation
3. Trade and regional integrations: Given the small economic size of most African countries, degree of integration with neighboring countries is important. Foreign investors, particularly those seeking export platforms, select a host country based on their level of economic connection with a neighboring country. In addition to already formed regional trade agreements, we have also constructed an indicator of market potential that proxy a country's export platform potential. Hence, the two indicators used to proxy degree of integration are a country's market potential[6] (taking into account neighboring countries), and membership in a regional trade integration.[7]
4. Infrastructure: Mobile subscription and access to electricity.[8]
5. Labor and skill indicators: Cheap labor has been one of the driving forces for foreign investors to look for host countries in developing world. Not just labor per se, there are several other labor-related factors that matter including skill level of workers, proportion of wage workers and employers' obligation to labor. As such, we use the following indicators to proxy labor-

[6] Market potential (MP) of a country is computed as a distance-weighted GDP of countries surrounding it.

$MP_i = \frac{\sum_j^N GDP_j}{distance_{ij}}$ *where* $i \neq j$ *and* N *is the number of countries in the sample*

[7] Six major regional trade agreements in Africa are considered for estimation. These are COMESA, EAC, CEMAC, ECOWAS, SADC, and WAEMU. We have weighted each of these RTAs are weighted by each member countries MP index.

[8] Road network density has been used often to proxy infrastructure, but given our sample countries and years covered, there is not enough data for each country per year to use this variable in our spatial estimation.

related factors: proportion of wage workers, share of employment, total population, average years of schooling at secondary school, employers labor tax and other contributions.

Table 2 reports mean values of key model variables, including FDI values for China and US by country. The top destination for Chinese FDI are Angola, Egypt, Kenya, Mozambique, Nigeria, Senegal, South Africa, Uganda, and Zambia, where China invested an average of over one billion dollars each year during 2000-2017 period. For US FDI the top destinations are Algeria, Egypt, Ghana, Libya, Nigeria, South Africa, and Tanzania with over one billion dollars average investment per year. The three largest economies in Africa (Nigeria, South Africa, Egypt) attract the highest investment from both home countries. Only thirteen countries out of the 39 in our sample had more than 50% wage workers, out of this only four countries (Botswana, Namibia, South Africa, and Tunisia) had more than 70% of their workers as wage workers. Access to electricity and mobile subscription rate varies across countries based on their economic size and growth, topping the list are Algeria, Egypt, Gabon, Ghana, South Africa, and Tunisia. Domestic credit is available mostly in north Africa countries including Algeria, Egypt, Libya, Morocco, and Tunisia as well as Namibia and South Africa. In these countries available domestic credit is more than 50% of GDP of each country.

IV. Results and Discussion

We estimate both the random and fixed models and conduct a the Hausman specification testing. The test result shows that the fixed effects specification is appropriate for the data under various alternative specifications both for the Chinese and U.S. FDI datasets.[9]

Tables 3 and 4 report results for the case of Chinese FDI to Africa, respectively. Table 3 reports results from SAR, SLX and a combination of the two, SDM. Table 4 reports results from the spatial error model (SEM) and a combination of this model with other specifications. As noted above, in both tables standard linear models (both the fixed and random effects) are reported to check

[9] For the sake of completeness, we have reported results from both the basic random effects (without the spatial effects) for comparison purposes.

robustness of our findings. Tables 5 and 6 report results from similar specifications for the case of US FDI.

Our results show that for both countries there is some evidence of spatial interdependence mostly through error term and dependent variables, or some combination of the two specifications. For the case of China, there is evidence of spatial interdependence in all three specifications (i.e. the SAR, SLX and SEM), but the spatial autoregressive lag effect losses its significance once lag explanatory variables are included in estimation. For the case of the U.S. there is evidence of spatial interdependence through the error term and a combination of error, lag dependent and explanatory variables. In addition to the presence of neighboring country, GDP growth of a country lowers FDI inflows from both China and US into the sample of African countries. This may be due to two reasons related to high GDP growth in an African country. First, most countries with high GDP growth rates are those that expanded (or discovered new) export of natural resources. Second, some of these countries exhibit expansion of service sector, not as much in the manufacturing sectors (contrary to expectations of traditional structural transformation). Such countries may not be a suitable destination for firms looking to expand the manufacturing sector (Chinese firms) or have limitations on the foreign firms' investment in the service sector. Although the level of significance varies from one specification to the other, the following variables have also the expected signs in both countries: rate of mobile phone subscription, access to domestic credit, and a country's rent from natural resource use have had positive impact on the inflows of FDI both China and the U.S. For FDI from both countries, market potential of neighboring countries is not a significant driving force to attract FDI. In fact, the coefficient has a negative sign for the case of Chinese FDI, for the case of U.S. FDI it is positive but not significant. In other words, at least for FDI from the U.S. there

is a tendency for a higher market potential of neighboring countries seems to attract them to a host country. The positive sign on the market potential coefficient also confirms that is an export platform motivations that investors from the U.S may have to locate in an African country. The positive sign, though insignificance, on some of the distance-weighted regional trade agreement variables also confirms the same notion. That is, distance-weighted regional trade agreements among African countries, which are expected to create bigger regional markets within signatory countries have not been the main driving force to attract foreign investors from China and U.S as expected.

There are even more differences in both the significance and sign of the coefficients on some of the variables between the FDI inflows from the two countries. First, GDP of a country, that measures economic size, significantly and positively affect inflow of U.S. FDI, but not that of Chinese FDI. The finding attests that most U.S FDI are motivated by market size (or market-driven) and hence their investment motivation falls under horizontal FDI category. In terms of variables to proxy infrastructure (mobile phone subscription), Chinese investors seem to be not affected by availability and access to infrastructure in a host African country. Whereas for investors from the U.S, both proxy variables have the expected positive signs, and access to electricity is highly significant in attracting U.S. FDI. This is consistent with the notion that U.S. investors are attracted to countries with well-established infrastructure and networked consumer base; for Chinese investors it seems infrastructure is not a primary attraction factor.

Labor and skill indicators don't seem to influence decision of investors from both countries. For investors from both countries, proportion of wage employment in a host country had a negative effect but none of the coefficients are significant. Although insignificant, these results attest to the congestion effect due to rising wage in a host country. Here we assume that proportion of wage

employment may contain some information about the wage rate in a country, that is, a country with high proportion of wage employment will have a relatively higher wage rate. As such one can argue that congestion effect is not deterring investors from both countries from investing in a host African country. For the case of U.S FDI, the third country effect of wage workers has large positive sign, although insignificant. That is, if a neighboring country has a higher proportion of wage workers, U.S. FDI is attracted to a host country to avoid congestion in a neighboring country. We argue that this may be the case for the U.S. since investors from the U.S. go to countries with relatively larger market and connected consumers, and hence congested markets.

Skill level (proxied by average number of schooling in second school) also has negative effect on inflow of FDI from both countries, in fact it is significant for the case of Chinese FDI. Why is skill level not important to attract foreign investors? Isn't the blame for lack of FDI in African often times lack of a skilled labor force? We can offer an explanation as to why we obtained this result, that is years of schooling at the secondary level may not be a good proxy to measure actual skill set that most foreign investors look for[10] and, in fact, unemployed youth without relevant skill may be more of a liability than an opportunity for a host country. The other labor-related variable that has a positive coefficient (at least weakly significant) for the case of U.S. FDI is employers' contributions for labor tax and other mandatory payments. This is expected since U.S. firms are used to similar contributions at home and may also be doing this to attract highly skilled workers in a host country.

[10] We have tried to use average years of schooling at tertiary school level, but due to missing observation for several countries/years, we couldn't use this variable in our spatial estimation.

Indirect impacts or spillover effect from a neighboring country

Tables 7 and 8 report direct and indirect impacts of key explanatory variables for Chinese FDI and U.S FDI, respectively. The interpretation of the direct effect is similar to the standard marginal effects, so we don't repeat that here. The indirect effects are the influences on the dependent variable in country k resulting from a change in the explanatory variable in other (neighboring) countries due to the indirect spatial spillovers effect. We will discuss significant indirect effects for both Chinese and U.S FDI.

The indirect effects are similar to the coefficients from the spatial regressors reported in the previous tables. There are differences between China and US in terms of indirect effects. Similar to the previous results, for the case of China only two variables had indirect impacts: domestic credits and share of service sector of neighboring countries. Specifically, an increase in domestic credit in neighboring countries by 10% result in a 9% increase in Chinese FDI in a host country. On the other hand, a 10% increase in share of service sector in neighboring countries may result in a 70% decrease in Chinese FDI to a host country; however, it may take a decade or more for the share of service sector to increase by 10% in a given host country.

Our finding shows that U.S FDI react to changes in neighboring countries factors more than Chinese FDI. GDP, access to electricity, proportion of wage workers, gross fixed capital formation, cost of business start-up and share of service sector of neighboring countries significantly affect US FDI at various levels of significance. Except for gross fixed capital formation, all other variables help attract U.S FDI to a host country. A 10 % increase in the proportion of wage workers, access to electricity, and share of service sector in GDP result in 146%, 5%, 61%, and 145%, respectively, increase in the U.S FDI inflow to a host country. These results attest to the fact that U.S investors are more sensitive

to situation in countries surrounding a host country and take a holistic approach when making investment decision. This is unlike Chinese investors which place little attention to the situation in neighboring countries economic situation.

Conclusions

The purpose of this study is to look into the role of spatial interdependence or third country effect in affecting the location decision of Chinese and U.S FDI. We tracked thirty nine African countries over eighteen years. . The results reveal that there are evidence of agglomeration as well as congestion effects that influence location decision of FDI going into Africa..

Using Chinese and U.S overseas investment data, this study presents empirical evidence on the importance of spatial interdependence, in addition to traditional determinants, in influencing location choice. Our findings show that neighboring countries are important in influencing the decisions of Chinese and U.S. FDI flows to African countries. For investment from both countries the third country effect comes through explanatory variables (including market size, trade cost, share of wage workers, access to electricity, and share of service sector), although there is stronger evidence for the case of U.S when compared to the Chinese FDI. Unlike previous studies, the effect of the spatial lag effect losses its significance when other third country factors are controlled for. Overall, there is evidence that, unlike Chinese FDI, U.S FDI seem to be market-seeking and takes into account neighboring countries' economic situation to invest in in a host country.

There are three caveats in this study. First, Chinese FDI is obtained from unofficial source and hence its validity is subject to criticism. Second, we couldn't find some key labor-related complete data (for instance, labor cost, education attainment level, etc.) for most of the countries for our

sample to test the congestion effect that manifested through an increase in labor cost. Third, our unit of analysis is country, which is broad to clearly see the agglomeration and congestion effects; but given lack of FDI data at the province or city level, we had to use country. We are working on a firm level FDI data by country in our future research to overcome this problem. Despite these shortcomings, we believe that the insights from this study provide relevant insights for policy-makers in developing countries in general and Africa in particular.

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Table 1. Definitions of Variables and Sources

Variables	Description	Source
S FDI outflow	U.S FDI outflow to 39 African countries	U.S. BEA
Chinese FDI outflow	Chinese FDI outflow to 39 African countries	China Global Investment Tracker (CGIT) and Chinese Ministry of Commerce (MOC)
Economic Structure		
GDP at constant 2010 $	GDP (constant 2010 US$)	WDI
GDP growth rate	GDP growth (annual %)	WDI
Domestic credit	Domestic credit provided by financial sector (% of GDP)	WDI
Trade (Exports of goods and services)	Exports of goods and services (% of GDP)	WDI
Gross fixed capital formation	Gross fixed capital formation (% of GDP)	WDI
Services value added	Services, value added (% of GDP)	WDI
Total natural resource rents	Total natural resources rents (% of GDP) [	WDI
Infrastructure		WDI
Mobile phone subscription	Mobile cellular subscriptions (per 100 people)	WDI
Access to electricity	Access to electricity (% of population)	WDI
Government regulation and stability		
Tax revenue	Tax revenue (% of GDP)	WDI
Cost of business start-up	Cost of business start-up procedures (% of GNI per capita)	WDI
Political stability	Political Stability and Absence of Violence/Terrorism: Percentile	WDI
Regulatory quality	Regulatory Quality: Percentile Rank	WDI
Labor and skill		WDI
Employment to population	Employment to population ratio, 15+, total (%) (modeled ILO	WDI
Labor force participation	Labor force participation rate, total (% of total population ages	WDI
Population, total	Population, total	WDI
Labor tax and contributions	Labor tax and contributions (% of commercial profits)	WDI
Wage and salaried workers	Wage and salaried workers, total (% of total employment) (modeled	WDI
Trade and regional integration		
Regional Trade Integration (RTA)	Dummy variable that takes a value of 1 for a member country (zero otherwise) is used to create RTA indicators. Six major regional trade agreements in Africa are considered for estimation. These are COMESA, EAC, CEMAC, ECOWAS, SADC, and WAEMU. We have weighted each of these RTAs are weighted by each member countries MP index.	WTO
Net Export	Exports – Imports	
Trade Cost	Inverse of trade openness index (1/(exports + imports)	Own computation using openness data from WDI
Market Potential	Market potential (MP) of a country is computed as a distance-weighted GDP of countries surrounding it. $$MP_i = \frac{\sum_j^N GDP_j}{distance_{ij}}$$ where $i \neq j$ and N is the number of countries in the sample	Own computation using distance data from CEPII

Table 2. Mean values of key explanatory variables and FDI values for China and the US: 2000-2017

Country	FDI_C	FDI_U	GDP (in bn)	Pop (in mill)	Mobile Subscription	Access to electricity	Wage workers	Business Taxes	Domestic Credit	Gross Fixed Capital Formation	Net Export	Natural Resource Rent	Political Stability	Regulatory Quality
Algeria	1.00	3031.00	199.17	41.32	121.71	99.54	69.06	3.28	67.92	42.36	-10.86	15.24	15.76	10.58
Angola	3361.00	781.00	101.67	29.78	45.73	39.04	28.45	2.92	29.56	24.24	5.75	15.16	35.29	12.50
Benin	1.00	3.00	9.63	11.18	79.50	42.77	10.81	3.04	28.37	29.38	-13.00	7.69	49.10	33.17
Botswana	101.00	1.00	17.24	2.29	142.41	62.85	82.33	1.28	17.05	29.97	5.90	0.55	86.71	69.71
Cameroon	521.00	10.00	36.36	24.05	82.93	61.28	24.58	-0.69	16.56	23.97	-4.02	6.51	13.38	20.19
Chad	311.00	1.00	12.27	14.90	39.28	9.96	8.15	1.34	25.52	21.86	-5.89	18.87	10.52	9.13
Congo, Dem. Rep.	571.00	231.00	33.28	81.34	44.36	17.88	42.69	2.67	8.40	21.58	-3.83	34.57	4.81	5.29
Congo, Rep.	131.00	77.00	13.77	5.26	97.11	52.73	23.60	3.13	36.31	23.23	28.86	27.18	29.57	7.21
Cote D'Ivoire	191.00	1.00	39.50	24.29	131.68	64.51	24.67	2.88	37.44	20.47	2.31	5.91	12.90	37.98
Djibouti	1.00	1.00	1.84	0.96	39.98	51.54	58.51	0.83	34.96	25.91	-40.04	0.56	21.00	28.37
Egypt	3631.00	9353.00	271.71	97.55	106.54	100.00	69.29	1.48	99.05	15.82	-13.49	4.07	10.05	17.31
Equatorial Guinea	721.00	655.00	14.31	1.27	49.88	68.30	59.90	0.00	21.45	11.24	19.25	17.81	41.48	6.25
Eritrea	1.00	1.00	3.40	4.98	11.63	47.85	51.12	4.31	41.50	15.19	49.90	122.22	23.86	1.44
Ethiopia	1101.00	1.00	57.71	104.96	60.66	52.38	11.28	-0.36	-7.95	40.00	-15.97	11.72	8.62	13.94
Gabon	1.00	1.00	19.01	2.03	132.51	92.48	65.43	0.34	18.21	22.44	25.82	14.45	42.90	22.60
Ghana	391.00	1699.00	50.62	28.83	128.46	82.88	26.88	.	24.50	21.58	-3.13	15.92	50.52	49.52
Guinea	141.00	1.00	10.48	12.72	86.23	36.04	8.40	3.49	19.61	75.61	-61.31	26.10	25.76	17.79
Kenya	4351.00	406.00	58.11	49.70	87.15	70.40	38.03	1.69	40.30	18.83	-10.91	2.86	13.86	43.75
Liberia	251.00	875.00	2.58	4.73	54.95	25.76	19.65	1.57	28.86	21.49	-74.42	56.09	31.48	15.38
Libya	1.00	1059.00	46.63	6.37	88.11	98.54	58.91	-1.61	53.94	68.08	3.27	17.01	4.33	0.96
Madagascar	1.00	1.00	10.79	25.57	35.14	26.76	10.58	0.41	18.98	16.15	-3.62	11.75	33.86	26.44
Malawi	1.00	38.00	9.06	18.62	42.74	11.20	38.99	0.53	22.24	14.43	-7.00	13.11	36.24	23.56
Mali	161.00	1.00	14.15	18.54	95.76	32.54	11.19	1.36	32.14	21.52	-15.61	13.02	7.19	30.29
Mauritania	1.00	93.00	5.76	4.42	93.17	43.80	52.11	4.04	4.25	52.51	-27.11	29.54	25.29	23.08
Morocco	871.00	413.00	119.35	35.74	123.88	100.41	46.27	0.34	108.83	29.42	-9.51	2.34	31.95	44.71
Mozambique	1321.00	399.00	15.40	29.67	41.03	24.40	11.32	-0.22	32.07	25.59	-31.96	22.26	15.29	25.00
Namibia	1.00	1.00	14.80	2.53	105.50	52.86	70.17	0.79	78.80	17.04	-10.80	5.04	69.57	46.63
Niger	1.00	1.00	8.50	21.48	41.88	15.83	10.64	1.41	21.43	34.66	-16.34	14.26	11.00	26.92
Nigeria	2681.00	5775.00	460.46	190.89	76.92	66.10	18.48	-1.20	23.28	15.72	-0.00	6.26	6.24	16.83
Rwanda	251.00	12.00	9.34	12.21	73.24	35.94	19.50	0.41	18.95	23.91	-14.53	6.70	48.62	60.58
Senegal	1081.00	26.00	22.95	15.85	100.42	68.50	53.27	1.67	37.60	25.03	-13.68	5.30	44.33	49.04
Sierra Leone	1.00	14.00	3.50	7.56	92.63	24.13	10.00	0.00	21.94	18.98	-21.98	27.87	47.67	15.87
South Africa	1231.00	7335.00	426.81	56.72	162.99	82.90	84.99	1.16	180.54	19.73	1.37	5.08	36.71	62.50
Tanzania	461.00	1384.00	50.10	57.31	70.72	47.10	13.68	1.72	18.08	34.11	-2.37	7.75	26.71	29.81
Togo	1.00	1.00	5.06	7.80	80.77	48.83	18.65	2.69	48.50	27.86	-19.25	19.80	20.52	21.63
Tunisia	1.00	280.00	49.63	11.53	125.30	100.00	72.65	3.08	97.66	19.69	-12.40	2.92	14.81	36.06
Uganda	1351.00	43.00	28.58	42.86	59.21	34.90	22.20	-2.30	23.16	24.19	-7.21	17.92	28.14	45.67
Zambia	2241.00	59.00	27.96	17.09	79.61	23.34	22.06	1.13	21.76	35.39	-1.15	14.06	51.48	33.65
Zimbabwe	151.00	38.00	17.99	16.53	86.25	42.59	34.31	2.12	235.69	10.67	-10.71	9.29	19.10	3.85
Total	707.41	874.41	58.96	29.27	82.51	52.79	35.97	1.33	43.27	26.66	-8.71	16.79	28.37	26.80

Table 3. Determinants of location choice for China FDI in Africa: Impacts of Traditional, Spatial lag, Spatial Regressors and combinations (Dependent Variable: Log of Chinese FDI)

	Fixed Effect	Random effect	Spatial Auto	W (FDIj)	Spatial X	W(Xj)	Spatial Auto and X	W (FDIj and Xj)
GDP	-0.582	0.164	-0.786		-0.256	9.479	-0.244	8.885
	(-0.58)	(0.40)	(-0.69)		(-0.21)	(1.35)	(-0.20)	(1.27)
Population	5.035	0.839*	2.607		-0.483	23.796	-0.422	21.103
	(1.47)	(1.91)	(0.54)		(-0.09)	(1.12)	(-0.08)	(0.99)
GDP Growth	-0.019	-0.027**	-0.036**		-0.040**		-0.040**	
	(-1.45)	(-2.20)	(-2.68)		(-2.95)		(-2.94)	
Market Potential	7.715*	-0.422	2.468		-4.484	0.842	-3.287	-1.777
	(1.90)	(-0.45)	(0.48)		(-0.45)	(0.06)	(-0.33)	(-0.13)
Mobile Subscription	0.406	0.655**	0.183		0.487		0.505	
	(1.47)	(3.23)	(0.54)		(1.34)		(1.39)	
Access to Electricity	-0.599**	-0.155	-0.291		-0.292		-0.300	
	(-2.40)	(-0.87)	(-1.01)		(-1.00)		(-1.03)	
Wage Workers	0.358	0.471	-0.196		-0.863	-3.539	-0.871	-3.036
	(0.27)	(1.04)	(-0.14)		(-0.62)	(-0.39)	(-0.63)	(-0.34)
Employment	3.713	1.818	5.743		3.878	15.121	3.788	14.421
	(1.24)	(1.26)	(1.55)		(0.98)	(0.79)	(0.96)	(0.76)
Average Years of Secondary Education	-0.236	0.007	-2.562*		-1.543		-1.548	
	(-0.23)	(1.23)	(-1.92)		(-1.09)		(-1.09)	
Labor- Tax and other contributions	0.050	-0.069	1.723*		1.419		1.382	
	(0.11)	(-0.29)	(1.71)		(1.39)		(1.35)	
Business and other taxes	-0.262	0.018	-0.244		-0.193		-0.179	
	(-1.41)	(0.17)	(-1.05)		(-0.80)		(-0.75)	
Domestic credit	0.007	0.003	0.008		0.010	0.079**	0.010	0.074**
	(1.08)	(0.62)	(1.08)		(1.20)	(2.45)	(1.20)	(2.28)
Gross fixed capital formation	0.697**	0.520**	0.808**		0.828**		0.849**	
	(2.40)	(1.96)	(2.58)		(2.62)		(2.69)	
Trade Cost	1.022	0.584	-0.195		0.337	-0.154	0.356	-0.122
	(1.64)	(1.21)	(-0.27)		(0.43)	(-0.08)	(0.46)	(-0.07)
Net Export	-0.002	0.002	0.007		0.001	0.024	0.001	0.018
	(-0.25)	(0.30)	(0.65)		(0.11)	(0.49)	(0.06)	(0.37)
Natural resource rent	0.266	0.219	-0.079		0.016		0.016	
	(0.95)	(1.13)	(-0.24)		(0.05)		(0.05)	
Cost of business start-up	0.184	0.276*	-0.164		-0.058	1.640	-0.055	1.904*
	(1.01)	(1.87)	(-0.70)		(-0.24)	(1.43)	(-0.23)	(1.65)
Political Stability	0.223	0.371*	-0.069		-0.014		-0.021	
	(0.87)	(1.76)	(-0.24)		(-0.05)		(-0.07)	
Regulatory Quality	1.141**	0.438*	1.177**		1.009**		0.978**	
	(3.11)	(1.78)	(2.77)		(2.34)		(2.27)	
Share of service sector	-1.252*	-1.052*	-0.742		-0.752	-5.991*	-0.716	-5.612*
	(-1.74)	(-1.73)	(-0.89)		(-0.84)	(-1.90)	(-0.80)	(-1.78)
Time trend	-0.172	0.170**	0.118		-0.314		-0.189	
	(-1.11)	(2.88)	(0.45)		(-0.41)		(-0.25)	
COMESAMP	-0.000	0.000	0.000		-0.000		-0.000	
	(-0.34)	(0.94)	(0.20)		(-0.48)		(-0.59)	
EACMP	0.000	-0.000	-0.000		-0.000		-0.000	
	(0.02)	(-1.42)	(-0.11)		(-0.23)		(-0.19)	
CEMACMP	0.000	0.000*	0.000		0.000		-0.000	
	(0.02)	(1.80)	(0.65)		(0.06)		(-0.00)	
ECOWASMP	0.000	0.000	0.000		0.000		0.000	
	(1.20)	(1.46)	(0.70)		(0.25)		(0.27)	
SADCMP	0.000	0.000	0.000		0.000		-0.000	
	(0.89)	(1.16)	(0.86)		(0.01)		(-0.03)	
WAEMUMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.90)	(-2.33)	(-1.46)		(-1.17)		(-1.22)	
lnFDI_C				0.212**				0.152
				(2.12)				(1.41)
Observations	697	697	507		507		507	
chi2		419.633	326.045		343.608		347.729	
P	0.000	0.000	0.000		0.000		0.000	
chi2_c			4.474		15.634		17.728	
p_c			0.034		0.111		0.088	
Ll	-1553.986		-1017.189		-1011.64		-1010.669	

Marginal effects; t statistics in parentheses, (d) for discrete change of dummy variable from 0 to 1, * p<.10, ** p<.05, *** p<.001

Table 4. Determinants of location choice for China FDI in Africa: Impacts of Traditional, Spatial error, Spatial lag, and Spatial Regressors and combinations (Dependent Variable: Log of Chinese FDI)

	Fixed effect	Random effect	Spatial error	W (error)	Spatial Error and Auto	W (error and auto)	Spatial Error and X	W (error and X)
GDP	-0.582	0.164	-0.829		-0.679		-0.679	8.084
	(-0.58)	(0.40)	(-0.73)		(-0.60)		(-0.60)	(1.15)
Population	5.035	0.839*	3.014		1.938		1.938	21.750
	(1.47)	(1.91)	(0.62)		(0.40)		(0.40)	(1.04)
GDP Growth	-0.019	-0.027**	-0.035**		-0.036**		-0.036**	
	(-1.45)	(-2.20)	(-2.64)		(-2.74)		(-2.74)	
Market Potential	7.715*	-0.422	3.063		1.574		1.574	-0.603
	(1.90)	(-0.45)	(0.55)		(0.33)		(0.33)	(-0.05)
Mobile Subscription	0.406	0.655**	0.197		0.168		0.168	
	(1.47)	(3.23)	(0.57)		(0.52)		(0.52)	
Access to Electricity	-0.599**	-0.155	-0.302		-0.272		-0.272	
	(-2.40)	(-0.87)	(-1.05)		(-0.94)		(-0.94)	
Wage Workers	0.358	0.471	-0.201		-0.196		-0.196	-2.733
	(0.27)	(1.04)	(-0.15)		(-0.14)		(-0.14)	(-0.31)
Employment	3.713	1.818	5.525		5.960		5.960	11.480
	(1.24)	(1.26)	(1.48)		(1.62)		(1.62)	(0.57)
Average Years of Secondary Education	-0.236	0.007	-2.486*		-2.662**		-2.662**	
	(-0.23)	(1.23)	(-1.86)		(-1.99)		(-1.99)	
Labor- Tax and other contributions	0.050	-0.069	1.674*		1.776*		1.776*	
	(0.11)	(-0.29)	(1.65)		(1.78)		(1.78)	
Business and other taxes	-0.262	0.018	-0.245		-0.244		-0.244	
	(-1.41)	(0.17)	(-1.05)		(-1.05)		(-1.05)	
Domestic credit	0.007	0.003	0.009		0.008		0.008	0.070**
	(1.08)	(0.62)	(1.11)		(1.04)		(1.04)	(2.13)
Gross fixed capital formation	0.697**	0.520**	0.803**		0.800**		0.800**	
	(2.40)	(1.96)	(2.58)		(2.54)		(2.54)	
Trade Cost	1.022	0.584	-0.151		-0.236		-0.236	-0.040
	(1.64)	(1.21)	(-0.20)		(-0.33)		(-0.33)	(-0.02)
Net Export	-0.002	0.002	0.007		0.008		0.008	0.019
	(-0.25)	(0.30)	(0.61)		(0.68)		(0.68)	(0.40)
Natural resource rent	0.266	0.219	-0.061		-0.109		-0.109	
	(0.95)	(1.13)	(-0.18)		(-0.33)		(-0.33)	
Cost of business start-up	0.184	0.276*	-0.171		-0.145		-0.145	1.719
	(1.01)	(1.87)	(-0.73)		(-0.62)		(-0.62)	(1.46)
Political Stability	0.223	0.371*	-0.060		-0.070		-0.070	
	(0.87)	(1.76)	(-0.21)		(-0.25)		(-0.25)	
Regulatory Quality	1.141**	0.438*	1.160**		1.187**		1.187**	
	(3.11)	(1.78)	(2.72)		(2.82)		(2.82)	
Share of service sector	-1.252*	-1.052*	-0.708		-0.840		-0.840	-5.487*
	(-1.74)	(-1.73)	(-0.85)		(-1.00)		(-1.00)	(-1.75)
Time trend	-0.172	0.170**	0.168		0.105		0.105	
	(-1.11)	(2.88)	(0.60)		(0.45)		(0.45)	
COMESAMP	-0.000	0.000	0.000		0.000		0.000	
	(-0.34)	(0.94)	(0.18)		(0.24)		(0.24)	
EACMP	0.000	-0.000	-0.000		-0.000		-0.000	
	(0.02)	(-1.42)	(-0.13)		(-0.07)		(-0.07)	
CEMACMP	0.000	0.000*	0.000		0.000		0.000	
	(0.02)	(1.80)	(0.53)		(0.85)		(0.85)	
ECOWASMP	0.000	0.000	0.000		0.000		0.000	
	(1.20)	(1.46)	(0.59)		(0.84)		(0.84)	
SADCMP	0.000	0.000	0.000		0.000		0.000	
	(0.89)	(1.16)	(0.79)		(1.00)		(1.00)	
WAEMUMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.90)	(-2.33)	(-1.48)		(-1.44)		(-1.44)	
e.lnFDI_C				0.186*		-0.256		-0.256
				(1.65)		(-1.06)		(-1.06)
lnFDI_C						0.368**		
						(2.44)		
Observations	697	697	507		507		507	
chi2		419.633	222.486		484.876		484.876	
p	0.000	0.000	0.000		0.000		0.000	
chi2_c			2.714		8.673		8.673	
p_c			0.099		0.013		0.013	
ll	-1553.98		-1018.04		-1016.738		-1016.738	

Marginal effects; t statistics in parentheses, (d) for discrete change of dummy variable from 0 to 1, * p<.10, ** p<.05, *** p<.001

Table 5. Determinants of location choice for US. FDI in Africa: Impacts of Traditional, Spatial lag, Spatial Regressors and combinations (Dependent Variable: Log of U.S FDI)

	Fixed Effect	Random effect	Spatial Auto	W (FDIj)	Spatial X	W(Xj)	Spatial Auto and X	W (FDIj and Xj)
GDP	1.531**	1.512***	2.451**		2.659***	8.838**	2.680***	8.932**
	(2.35)	(4.09)	(3.25)		(3.40)	(2.00)	(3.43)	(2.02)
Population	-3.100	-0.632	-4.300		-5.176	-5.484	-5.291	-7.429
	(-1.39)	(-1.55)	(-1.33)		(-1.54)	(-0.40)	(-1.57)	(-0.52)
GDP Growth	-0.021**	-0.023**	-0.015*		-0.019**		-0.019**	
	(-2.56)	(-2.73)	(-1.70)		(-2.17)		(-2.14)	
Market Potential	-4.429*	-0.318	-4.899		-13.483**	13.338	-13.213**	12.695
	(-1.67)	(-0.31)	(-1.43)		(-2.13)	(1.54)	(-2.08)	(1.46)
Mobile Subscription	0.226	-0.072	0.067		0.077		0.074	
	(1.26)	(-0.51)	(0.30)		(0.33)		(0.31)	
Access to Electricity	0.730***	0.645***	0.698***		0.786***		0.782***	
	(4.49)	(4.80)	(3.64)		(4.14)		(4.12)	
Wage Workers	-1.072	0.171	-0.930		-0.721	7.999	-0.712	8.277
	(-1.24)	(0.37)	(-1.03)		(-0.80)	(1.36)	(-0.79)	(1.40)
Employment	-2.040	-0.105	0.699		2.159	-16.031	2.134	-16.552
	(-1.05)	(-0.08)	(0.28)		(0.84)	(-1.30)	(0.83)	(-1.34)
Average Years of Secondary Education	0.043	-0.001	-0.085		-0.296		-0.330	
	(0.06)	(-0.12)	(-0.10)		(-0.32)		(-0.36)	
Labor- Tax and other contributions	0.064	0.340	0.086		-0.142		-0.131	
	(0.22)	(1.64)	(0.13)		(-0.21)		(-0.20)	
Business and other taxes	-0.043	0.005	-0.279*		-0.265*		-0.268*	
	(-0.36)	(0.05)	(-1.80)		(-1.69)		(-1.71)	
Domestic credit	0.005	0.005	0.000		0.000	0.019	0.000	0.018
	(1.07)	(1.50)	(0.09)		(0.07)	(0.94)	(0.04)	(0.88)
Gross fixed capital formation	-0.292	-0.375**	-0.615**		-0.629**		-0.632**	
	(-1.55)	(-2.08)	(-2.95)		(-3.06)		(-3.08)	
Trade Cost	-1.275**	-1.192***	-0.590		-1.273**	2.447**	-1.281**	2.444**
	(-3.15)	(-3.30)	(-1.21)		(-2.53)	(2.05)	(-2.54)	(2.05)
Net Export	0.002	-0.004	-0.006		0.001	-0.001	0.001	-0.000
	(0.30)	(-0.62)	(-0.75)		(0.16)	(-0.03)	(0.17)	(-0.00)
Natural resource rent	-0.017	0.157	0.119		0.133		0.124	
	(-0.09)	(1.04)	(0.54)		(0.61)		(0.57)	
Cost of business start-up	0.083	0.088	0.277*		0.338**		0.340**	
	(0.70)	(0.81)	(1.78)		(2.19)		(2.21)	
Political Stability	-0.388**	-0.384**	-0.365*		-0.246		-0.249	
	(-2.32)	(-2.56)	(-1.92)		(-1.31)		(-1.32)	
Regulatory Quality	-0.604**	-0.434**	-0.019		-0.074		-0.071	
	(-2.53)	(-2.22)	(-0.07)		(-0.26)		(-0.25)	
Share of service sector	0.931**	0.345	1.124**		1.528**	3.623*	1.553**	3.963*
	(1.99)	(0.80)	(2.03)		(2.64)	(1.82)	(2.68)	(1.92)
Time trend	0.158	-0.019	0.225		-0.337		-0.273	
	(1.56)	(-0.40)	(1.30)		(-0.70)		(-0.56)	
COMESAMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.26)	(-2.18)	(-0.75)		(-0.50)		(-0.54)	
EACMP	0.000***	0.000***	0.000		0.000		0.000	
	(4.05)	(4.09)	(1.53)		(0.12)		(0.14)	
CEMACMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.29)	(-3.11)	(-1.05)		(-0.76)		(-0.74)	
ECOWASMP	0.000	0.000**	0.000		0.000		0.000	
	(1.25)	(2.14)	(0.63)		(0.40)		(0.42)	
SADCMP	0.000	0.000	0.000		0.000		0.000	
	(1.26)	(0.50)	(1.24)		(0.59)		(0.62)	
WAEMUMP	-0.000**	-0.000***	-0.000		-0.000		-0.000	
	(-2.14)	(-3.92)	(-1.25)		(-0.98)		(-0.95)	
lnFDI_U				0.113				-0.068
				(1.16)				(-0.62)
Observations	697	697	507		507		507	
chi2		214.831	92.602		128.602		129.137	
p	0.000	0.000	0.000		0.000		0.000	
chi2_c			1.341		31.568		31.986	
p_c			0.247		0.000		0.000	
ll	-1254.349		-825.590		-810.976		-810.785	

Marginal effects; t statistics in parentheses, (d) for discrete change of dummy variable from 0 to 1, * p<.10, ** p<.05, *** p<.001

Table 6. Determinants of location choice for U.S FDI in Africa: Impacts of Traditional, Spatial error, Spatial lag, and Spatial Regressors and combinations (Dependent Variable: Log of Chinese FDI)

	Fixed effect	Random effect	Spatial error	W (error)	Spatial Error and Auto	W(error and auto)	Spatial Error and X	W(error and X)
GDP	1.531**	1.512***	2.379**		2.820***		2.762***	8.511**
	(2.35)	(4.09)	(3.14)		(3.85)		(3.56)	(2.02)
Population	-3.100	-0.632	-4.087		-5.515*		-5.550	-8.552
	(-1.39)	(-1.55)	(-1.24)		(-1.77)		(-1.64)	(-0.63)
GDP Growth	-0.021**	-0.023**	-0.015*		-0.015*		-0.018**	
	(-2.56)	(-2.73)	(-1.71)		(-1.80)		(-2.09)	
Market Potential	-4.429*	-0.318	-5.003		-4.202		-12.826**	12.099
	(-1.67)	(-0.31)	(-1.40)		(-1.53)		(-2.02)	(1.45)
Mobile Subscription	0.226	-0.072	0.076		0.034		0.037	
	(1.26)	(-0.51)	(0.34)		(0.17)		(0.16)	
Access to Electricity	0.730***	0.645***	0.706***		0.657***		0.774***	
	(4.49)	(4.80)	(3.68)		(3.50)		(4.06)	
Wage Workers	-1.072	0.171	-0.949		-0.863		-0.712	9.226
	(-1.24)	(0.37)	(-1.05)		(-0.97)		(-0.80)	(1.64)
Employment	-2.040	-0.105	0.711		1.033		2.467	-18.215
	(-1.05)	(-0.08)	(0.29)		(0.44)		(0.97)	(-1.48)
Average Years of Secondary Education	0.043	-0.001	-0.031		-0.430		-0.501	
	(0.06)	(-0.12)	(-0.04)		(-0.49)		(-0.54)	
Labor- Tax and other contributions	0.064	0.340	0.100		-0.067		-0.153	
	(0.22)	(1.64)	(0.15)		(-0.11)		(-0.23)	
Business and other taxes	-0.043	0.005	-0.273*		-0.293*		-0.271*	
	(-0.36)	(0.05)	(-1.76)		(-1.94)		(-1.72)	
Domestic credit	0.005	0.005	0.001		-0.000		-0.000	0.015
	(1.07)	(1.50)	(0.12)		(-0.06)		(-0.08)	(0.78)
Gross fixed capital formation	-0.292	-0.375**	-0.604**		-0.647**		-0.649**	
	(-1.55)	(-2.08)	(-2.91)		(-3.15)		(-3.14)	
Trade Cost	-1.275**	-1.192***	-0.590		-0.556		-1.390**	2.229*
	(-3.15)	(-3.30)	(-1.20)		(-1.20)		(-2.74)	(1.87)
Net Export	0.002	-0.004	-0.005		-0.006		0.002	0.002
	(0.30)	(-0.62)	(-0.73)		(-0.91)		(0.26)	(0.07)
Natural resource rent	-0.017	0.157	0.143		0.029		0.084	
	(-0.09)	(1.04)	(0.64)		(0.14)		(0.38)	
Cost of business start-up	0.083	0.088	0.275*		0.262*		0.343**	
	(0.70)	(0.81)	(1.77)		(1.73)		(2.22)	
Political Stability	-0.388**	-0.384**	-0.359*		-0.350*		-0.232	
	(-2.32)	(-2.56)	(-1.88)		(-1.90)		(-1.23)	
Regulatory Quality	-0.604**	-0.434**	-0.018		-0.047		-0.090	
	(-2.53)	(-2.22)	(-0.06)		(-0.17)		(-0.32)	
Share of service sector	0.931**	0.345	1.083*		1.115**		1.528**	4.257**
	(1.99)	(0.80)	(1.96)		(2.02)		(2.66)	(2.10)
Time trend	0.158	-0.019	0.225		0.210		-0.209	
	(1.56)	(-0.40)	(1.23)		(1.53)		(-0.44)	
COMESAMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.26)	(-2.18)	(-0.76)		(-0.65)		(-0.56)	
EACMP	0.000***	0.000***	0.000		0.000*		0.000	
	(4.05)	(4.09)	(1.52)		(1.68)		(0.12)	
CEMACMP	-0.000**	-0.000**	-0.000		-0.000		-0.000	
	(-2.29)	(-3.11)	(-1.07)		(-0.60)		(-0.61)	
ECOWASMP	0.000	0.000**	0.000		0.000		0.000	
	(1.25)	(2.14)	(0.64)		(0.64)		(0.47)	
SADCMP	0.000	0.000	0.000		0.000		0.000	
	(1.26)	(0.50)	(1.18)		(1.60)		(0.69)	
WAEMUMP	-0.000**	-0.000***	-0.000		-0.000		-0.000	
	(-2.14)	(-3.92)	(-1.33)		(-0.83)		(-0.86)	
e.lnFDI_U				0.118		-0.624***		-0.174
				(1.05)		(-4.40)		(-1.27)
lnFDI_U						0.530***		
						(5.81)		
Observations	697	697	507		507		507	
chi2		214.831	89.669		155.196		139.607	
p	0.000	0.000	0.000		0.000		0.000	
chi2_c			1.106		34.460		36.057	

p_c			0.293		0.000		0.000	
Ll	-1254.35		-825.713		-822.148		-810.164	

Marginal effects; t statistics in parentheses, (d) for discrete change of dummy variable from 0 to 1, * p<.10, ** p<.05, *** p<.001

	Direct Impact				Indirect Impact				Total Impact			
	dy/dx	Std. Err.	z	P>z	dy/dx	Std. Err.	z	P>z	dy/dx	Std. Err.	z	P>z
GDP	-0.154	1.250	-0.120	0.902	10.198	8.708	1.170	0.242	10.044	9.240	1.090	0.277
Population	-0.232	5.123	-0.050	0.964	27.491	27.103	1.010	0.310	27.259	26.625	1.020	0.306
GDP Growth	-0.040	0.014	-2.950	0.003	-0.012	0.014	-0.850	0.398	-0.052	0.022	-2.320	0.020
Market Potential	-3.467	9.749	-0.360	0.722	-1.763	15.057	-0.120	0.907	-5.230	12.232	-0.430	0.669
Mobile Subscription	0.521	0.364	1.430	0.152	0.150	0.206	0.730	0.466	0.671	0.513	1.310	0.191
Access to Electricity	-0.299	0.293	-1.020	0.307	-0.086	0.128	-0.670	0.501	-0.385	0.390	-0.990	0.323
Wage Workers	-0.871	1.435	-0.610	0.544	-3.713	11.105	-0.330	0.738	-4.584	11.638	-0.390	0.694
Employment	3.826	4.036	0.950	0.343	15.648	25.009	0.630	0.532	19.474	26.673	0.730	0.465
Average Years of Secondary Education	-1.559	1.429	-1.090	0.275	-0.449	0.655	-0.690	0.493	-2.008	1.917	-1.050	0.295
Labor- Tax and other contributions	1.411	1.027	1.370	0.169	0.406	0.552	0.740	0.461	1.817	1.416	1.280	0.199
Business and other taxes	-0.187	0.242	-0.770	0.442	-0.054	0.094	-0.570	0.567	-0.240	0.320	-0.750	0.453
Domestic credit	0.011	0.008	1.300	0.192	0.092	0.042**	2.170	0.030	0.103	0.045	2.280	0.023
Gross fixed capital formation	0.844	0.318	2.650	0.008	0.243	0.285	0.850	0.394	1.087	0.489	2.220	0.026
Trade Cost	0.338	0.779	0.430	0.664	0.047	2.337	0.020	0.984	0.385	2.551	0.150	0.880
Net Export	0.001	0.012	0.120	0.907	0.024	0.061	0.400	0.690	0.026	0.064	0.400	0.687
Natural resource rent	0.006	0.336	0.020	0.987	0.002	0.097	0.020	0.987	0.007	0.432	0.020	0.987
Cost of business start-up	-0.029	0.244	-0.120	0.905	2.170	1.486	1.460	0.144	2.141	1.572	1.360	0.173
Political Stability	-0.027	0.291	-0.090	0.925	-0.008	0.085	-0.090	0.926	-0.035	0.375	-0.090	0.925
Regulatory Quality	1.002	0.435	2.300	0.021	0.289	0.354	0.820	0.415	1.291	0.667	1.940	0.053
Share of service sector	-0.804	0.905	-0.890	0.374	-7.184	4.267*	-1.680	0.092	-7.988	4.631	-1.720	0.085

Table 7. Direct and Indirect Impacts of explanatory variables on Chinese FDI flow to a host country (results from spatial error and regressor model)

Table 8. Direct and Indirect Impacts of explanatory variables on U.S FDI flow to a host country (results from spatial error and regressor model)

US FDI	Direct Impacts				Indirect Impacts				Total Impacts			
direct	dy/dx	Std. Err.	z	P>z	dy/dx	Std. Err.	z	P>z	dy/dx	Std. Err.	z	P>z
GDP	3.323	0.794	4.190	0.000	14.58**	6.656	2.190	0.028	17.908	6.995	2.560	0.010
Population	-6.615	3.267	-2.030	0.043	-11.565	20.111	-0.580	0.565	-18.180	20.100	-0.900	0.366
GDP Growth	-0.019	0.009	-2.270	0.023	-0.013	0.008	-1.600	0.110	-0.032	0.016	-2.070	0.039
Market Potential	-13.369	6.088	-2.200	0.028	14.218	9.324	1.520	0.127	0.849	7.351	0.120	0.908
Mobile Subscription	0.006	0.225	0.020	0.980	0.004	0.152	0.020	0.980	0.009	0.376	0.020	0.980
Access to Electricity	0.770	0.191	4.040	0.000	0.52**	0.251	2.070	0.038	1.291	0.388	3.320	0.001
Wage Workers	-0.504	0.905	-0.560	0.578	14.62*	7.828	1.870	0.062	14.114	8.154	1.730	0.083
Employment	2.597	2.540	1.020	0.307	-30.701	19.605	-1.570	0.117	-28.104	20.516	-1.370	0.171
Average Years of Secondary Education	-0.795	0.933	-0.850	0.395	-0.537	0.669	-0.800	0.422	-1.332	1.581	-0.840	0.400
Labor- Tax and other contributions	-0.355	0.656	-0.540	0.588	-0.240	0.463	-0.520	0.604	-0.595	1.113	-0.540	0.593
Business and other taxes	-0.283	0.158	-1.800	0.072	-0.191	0.132	-1.450	0.148	-0.475	0.276	-1.720	0.085
Domestic credit	-0.001	0.005	-0.230	0.817	0.035	0.031	1.140	0.253	0.034	0.032	1.050	0.294
Gross fixed capital formation	-0.669	0.206	-3.240	0.001	-0.452*	0.233	-1.940	0.052	-1.120	0.394	-2.840	0.005
Trade Cost	-1.318	0.501	-2.630	0.009	1.163	1.861	0.620	0.532	-0.155	1.877	-0.080	0.934
Net Export	0.000	0.007	0.050	0.960	0.008	0.043	0.180	0.859	0.008	0.043	0.180	0.855
Natural resource rent	0.057	0.213	0.270	0.788	0.039	0.146	0.270	0.791	0.096	0.359	0.270	0.789
Cost of business start-up	0.332	0.153	2.170	0.030	0.224*	0.136	1.650	0.098	0.557	0.269	2.070	0.039
Political Stability	-0.160	0.189	-0.840	0.400	-0.108	0.133	-0.810	0.417	-0.267	0.318	-0.840	0.400
Regulatory Quality	-0.174	0.272	-0.640	0.524	-0.117	0.192	-0.610	0.542	-0.291	0.461	-0.630	0.528
Share of service sector	1.329	0.582	2.280	0.022	6.176*	3.168	1.950	0.051	7.506	3.335	2.250	0.024