CHINA-AFRICA FOREIGN INVESTMENT INTERACTIONS: THE ROLE OF NATURAL RESOURCES AND CRITICAL INFRASTRUCTURES

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Abstract: This paper is about China-African foreign investment interactions. The purpose of this study is to examine the role natural resource and critical infrastructure play in attracting FDI from China. The underlying hypothesis has been tested repeatedly without reaching a consensus view or providing an answer to the basic questions. This is to be expected because FDI from China to Africa is determined by a large number of factors, making the results sensitive to the selected set of explanatory variables.

Design/methodology/approach-The study employs cross-sectional sample of the variables covering 10 selected African countries respectively, employing standard ordinary least squares to estimate the relationship hypothesized with the longitudinal data sets, within the context of gravity modelling. Thereafter, standard data panel techniques were employed which enabled us to differentiate between efficiency effects of fixed and random effects, taking into account robust standard errors which accounted for endogeneity, homoscedasticity and autocorrelation.

Findings-The study provides empirical evidence that does not support internationalization theory. The result of empirical analysis indicates that NATRES, EDU, ITT and INFR play key roles in China-Africa foreign investment interactions. Their coefficients were found to be statistically significant. Also, empirical result indicates that the coefficient of NATRES is positive, while that of EDU, ITT, and INFR were negative. The study concludes that, African countries with natural resources, high labour participation rates, in need of critical infrastructures, and sound macroeconomics conditions such as low inflation rates are important to facilitate better China-Africa foreign investment interactions.

Originality/value-The analytical foundation of the study is based on Dunning (1980) eclectic macroeconomic theory and the model adopted for this study is predicated on Dinkneh & Jiang (2020), which is the modified form of the original gravity model presented by Tinbergen (1962). The study emphasis shifted from significance as implied by empirical analysis, to robustness checks based on other qualitative indicators as derived by the authors in reaching conclusions regarding China-African foreign investments interactions.

Keywords: China, African Countries, Natural Resources, IT and telecommunications, Education Inflation Rates, Foreign Direct Investment, Policy Reforms.

1. Introduction

African countries are faced with the challenges of shortage in domestic resources to finance their development and now look outward for financial resources. Policy makers in Africa have in recent year pay more attention to macroeconomic policies that encourage and facilitate low interest Foreign Direct Investment (UNCTAD, 2022; and Asongu, 2014). Foreign Direct Investment (FDI) is a process whereby the residents of the source country attain ownership of assets with the intention to control the production, distribution and other activities of a firm in the host country. FDI has the potential of being mutually beneficial to the host country and donor. African countries are receiving more Chinese FDI inflow with economies like Angola, Zambia, Kenya, Cameroon,

Ethiopia, and Nigeria being among the top Chinese FDI recipients in Africa (CARI & Boston, 2021). Chinese FDI spread geographically revealed Angola has received the highest in Central African region, Sudan in North African region, Ethiopia in East African region, South Africa in South African region, and Nigeria in West African region (CARI & Boston, 2021). The vast majority of loan finance from China to Africa originates with China's official export credit agency, China Exim bank (56.1%) and closely followed by China Development Bank (24.2%). In addition, the Ministry of Commerce provides a modest amount of zero-interest foreign aid loans, grants, and in-kind aid, while Sinosure offers insurance against risks. Large Chinese companies also offer significant amounts of supplier credits directly to African borrowers.

Globally, the inflow of foreign capital plunged in 2017 with about 23% ($1.87 trillion in 2016 to about $1.43 trillion), which shows a downward trend on FDI. The decline in global FDI inflows created major problems for policymakers, particularly in developing countries and especially in Africa (UNCTAD, 2018; Osabuohien, Obiekwe, Urhie and Osabohien 2018). Although, total Chinese FDI inflows to Africa increased in recent time, the flow has been more to African countries with certain comparative advantages. This raises the issue of whether it is possible to put in place appropriate policies to attract Chinese FDI to African countries. It is in this context that this study seeks to identify the determinants of Chinese FDI inflows to 10 selected African countries. The sampled countries have demonstrated some marginal transformation in economies, organization and distribution of products. They are Nigeria, Kenya, Zambia, Angola, South Africa, Ethiopia, Egypt, Cameroon, Sudan, and Ghana.

The drive and competition for Chinese FDI have forced these countries to change their commercial policies, put in place certain infrastructure, and make effort towards stabilizing the macroeconomic environment. It is expected that, with these economic changes or transformation in these economies, they would emerge as a strong and preferred destination for Chinese FDI (CARI & Boston, 2021). The abundance of natural resources, high and active workforce, large market size, and improving infrastructural capacity in Africa have not significantly attracted FDI to stimulate economic development, nor bridge the huge poverty gap. Globally, Africa attracts over 26% of FDI and there is still slow growth, inadequate capital, and high unemployment in most African countries; some economic problems FDI should resolve (UNCTAD, 2022). Addressing some of these challenges requires clearer understanding of major factors determining Chinese FDI inflows to these African economies, and requires appropriate policy majors to be put in place. A number of studies have been carried out to determine factors influencing the inflows of Chinese FDI to Africa (Borros-Torsticca, 1999; Sahoo, 2010; Adisu, Sharkey & Okoroafo, 2010; Sanfilippo, 2010; Cheung, de Haan, Qian, & Yu 2011; Moosa, 2016; Ross, Omar, Xu & Pandey, 2019; and Dinkneh & Jiang, 2020). However, most studies considered transition economies like the Eastern Europe and Asian countries. Such studies in Africa concentrated in the Southern and Northern African countries.

There is no consensus; theoretically and empirically, on the determinants of Chinese FDI inflow to African countries. Therefore, it becomes imperative to study and determine factors influencing Chinese FDI flow to African countries. Empirical determinations of these factors will go a long way in reducing factors which have negative influence in attracting foreign investors. It is in this context the study seek to ascertain factors which determine Chinese FDI flow to sampled African countries for the period 2002 to 2021. The broad objective of the study was to examine the role natural resources and critical infrastructures play in attracting FDI from China to the selected African countries of Nigeria, Kenya, Zambia, Angola, South Africa, Ethiopia, Egypt, Cameroon, Sudan, and Ghana. The specific objectives of the study includes to examine: the influence of natural resource on Chinese FDI inflows; the impact of IT and telecommunications on Chinese FDI inflows; the influence of education; proxy of human capital, on Chinese FDI inflows; the effect of inflation rate on Chinese FDI inflows; and, the role geographical distance from China play on Chinese FDI inflows, to the selected African countries of Nigeria, Kenya, Zambia, Angola, South Africa, Ethiopia, Egypt, Cameroon, Sudan, and Ghana. To aid investigating the objectives, panel data approach was used for data analysis.

2. Literature Review

2.1 Conceptual Review

2.1.1 Foreign Direct Investments (FDI)

When defining FDI, it is important to distinguish between the two types or patterns of capital inflows across countries namely, Foreign Direct Investments (FDI) and Foreign Portfolio Investments (FPI). The World Bank defines FDI as net inflows injected by an investor to acquire a 10% or more lasting management interest in a company that operates in an economy other than that of the investor (World Bank, 2020, Almfraji and Almsafir, 2014). The lasting interest implies a long-term relationship between the direct investor and the investee company; and the requirement of 10% or more necessitates significant influence to be exerted by the direct investor into the enterprise (UN, 1999). Both of these features are key distinguishing attributes of FDI. FPI relates to debt and equity capital invested by an entity resident in one country into an entity resident in another country with a primary goal of obtaining capital gains and not necessarily establishing a long-term relationship (UN, 1999). In other words, FPI is normally associated with the buying of shares, bonds, notes and money market instruments tradable on the stock exchange of the host country (UN, 1999; Sornarahaj, 2010).

2.1.2 Natural Resources in Host Country

Natural resources are resources that are drawn from nature and used with few modifications. They contribute a variety of essential elements to our well-being, including clean air, water and soil, etc. Asiedu (2006) concluded that even though endowment with natural resources plays an important role in encouraging FDI for a host country, it can still be attracted to countries that lack natural resources if their institutional and political environment has been improved. Internalization theory asserts the importance of equity based control in the exploitation of scarce natural resources, and so a positive association between the natural resources endowment of countries and Chinese OFDI is expected (Buckley and Casson, 1976). For the purpose of this study, natural resources endowment is measured in terms of total natural resources rents (% of GDP)

2.1.3 IT and Telecommunications in Host Country

Information and communications technology (ICT) has proven to be a key technology (OECD, 2023), and the important driver of growth (Kuppusamy, Murali and Geoffrey, 2009; Sassi and Goaied, 2013; Latif et al., 2018), and FDI (Xaypanya, Rang
kakulnuwat and Paweenawat, 2015; Asongu, Akpan and Isihak, 2018). In particular, developing countries with better telecommunications networks received greater FDI inflows (Lydon and Williams, 2005). The importance of ICT telecommunication has been addressed in various studies (Choi, 2003; Gani and Sharma, 2003; Gholami, Lee and Heshmati, 2005). A foreign investor that operates within the financial services knows the existence of an up-to-date IT and telecommunications infrastructure is critically important to serve customers optimally (Luiz and Charalambous 2009). Naudé and Krugell (2007), Williams (2015), and Masron (2017) proxied telecommunication infrastructure on fixed telephone. For this study, IT and telecommunications is proxied by the number of fixed telephone lines per 100 persons.

2.1.4 Education in Host Country

Human capital, economic development and foreign direct investment (FDI) are interconnected. Human capital which refers to a labour force participation rate, total (% of total population ages 15-64), is instrumental for economic growth and development because it boosts productivity and makes it possible to take advantage of technological progress. No matter what proxy is used to represent human capital, it turns out that the most important factor for attracting FDI is the variable employee compensation, which is the wage bill, implying that multinational firms look for cheap and also skilled labour in the host country (Abbas, Moosa and Ramiah, 2021). Human capital is believed to affect and be affected by FDI. Countries with higher levels of human capital are more likely to attract FDI because it tends to be more productive (and profitable) in countries with high levels of human capital. On the other hand, FDI contributes to human capital in the recipient countries because the investing firms provide technology and training for the local labour force

2.1.5 Inflation rate in Host Country

Volatile and unpredictable inflation rates in a host country discourage market-seeking FDI by creating uncertainty and by making long-term corporate planning problematic, especially in respect of price-setting and profit expectations. High rates of inflation may also lead to domestic currency devaluation, which in turn reduces the

real value of earnings in local currency for market-seeking inward-investing firms. High inflation rates tend to check the export performance of domestic and foreign investors and thereby discourage export-oriented FDI by increasing the prices of locally sourced inputs, making it harder to maintain a cost advantage in third markets. According to Onyeiwu and Shrestha (2004), a high rate of inflation reflects poor economic conditions in a country and will discourage the flow of FDI. So, in the context of previous literature, the lower the inflation rates of host countries, the greater the inflows of Chinese FDI.

2.1.6 Geographic Distance of Host Country from China

Internalization theory predicts that market-seeking firms are more likely to serve geographically proximate countries through exports and more distant markets via FDI (Buckley and Casson, 1981). This suggests a substitution of China's OFDI for other modes as distance increases. However, the dependent variable in this study is annual flow of Chinese FDI alone (i.e., not in the form of a ratio with exports). A physical distance variable is therefore used to complement our other variables to isolate its effect. The study incorporated distance as a control.

2.2 China-Africa Foreign Investments Interactions

The China-Africa relation came to the fore in 2006 when 48 African leaders attended a joint forum in Beijing, but the history of mutual links is markedly older than that. Since the start of the new millennium, China has supplemented development assistance with trade and investment which should, nevertheless, please the proponents of 'trade not aid' (CARI & Boston, 2021). The Chinese government has committed truly enormous sums to Africa, and global thinkers have argued that Chinese loans go disproportionately to resource-rich, poorly governed countries which are in contrast with the way other major actors operate. Brautigam & Jyhjong (2016) find that, this is only partially the case. Table 2.1 further supports the findings of Brautigam & Jyhjong (2016).

Table 2.1: China-Africa Foreign Investments Interactions (millions of US$, unadjusted)

Selected Country	African Region	Chinese FDI Receipts	% of Chinese FDI to Africa	China's Preference (In Africa)	% of Chinese FDI to Region	China's Preference (In Regions)
Angola	Central	42,619	27.69%	First	68.30%	Angola
Cameroon	Central	6,202	4.03%	Sixth	9.90%	
Ethiopia	East	13,729	8.92%	Second	28.90%	Ethiopia
Zambia	East	9,848	6.40%	Third	20.70%	
Kenya	East	9,175	5.96%	Fourth	19.30%	
Sudan	North	6,169	4.01%	Seventh	48.30%	Sudan
Egypt	North	5,282	3.43%	Eight	41.40%	
Nigeria	West	6,732	4.68%	Fifth	29.30%	Nigeria
Ghana	West	4,811	3.13%	Ninth	20.90%	
South Africa	South	3,857	2.51%	Tenth	71.40%	South Africa

Source: Author's Computation (2023)

The top recipient of government-to-government Chinese loans was a resource-rich country, Angola (27.69% of loans to African countries, and 68.30% of loans to Central Africa region) but the second largest recipient was a resource-poor country, Ethiopia (8.92% of loans to African countries, and 28.90% of loans to East Africa region). The other top recipients were Zambia (6.40% of loans to African countries, and 20.70% of loans to East Africa region), Kenya (5.96% of loans to African countries, and 20.70% of loans to East Africa region), Nigeria (4.68% of loans to African countries, and 29.30% of loans to West Africa region). Table 2.1 shows that the five top recipients of Chinese FDI inflows regionally are Angola (68.30%), Ethiopia (28.90%), Sudan (48.30%), Nigeria (29.30%), and South Africa (71.40%). This study provides answers to better understand how much the Chinese are lending to African countries, and how Chinese loan finance works. These are important for policy-makers in

Africa and academics globally. From questions of debt sustainability in Africa, to a clear-eyed understanding of the geopolitics of power, and getting the numbers right matters for our understanding of how China is going global, the risks and opportunities this poses, and the ways in which Africa's other partners like the US ought best to respond (CARI & Boston, 2021).

2.3 Theoretical Framework.

The study theoretical framework of FDI was explored under three categories of Macro-level, Micro-level and Development Theories. Macro-level FDI theories includes capital market theory (Markowitz, 1959), and exchange rate theory (Froot & Stein, 1991; and Kohlhagen, 1977) among others. Macroeconomic theories treat FDI as a form of capital flow between different economies in the world, and attempt to explain the motivations and determinants of FDI in macroeconomic context. Macro-level theories of FDI include Dunning (1988) OLI eclectic theory, Helpman, Melitz and Yeaple (2004) export versus FDI theory, and Buckley & Casson (1976) internalization theory, etc. Lastly, Development theories of FDI (mixed theories) include product life cycle theory (PLC) developed by Vernon (1966), and the Japanese theory developed by Ozawa (1970) and modified to five stages by Kojima and Ozawa (1984).

This study revisits the (Dunning, 1980) eclectic paradigm or the OLI paradigm to examine the role natural resource and critical infrastructure play in attracting FDI from China. The second pillar of the OLI paradigm, the location-specific advantages, has been widely used as the theoretical framework for FDI studies (Cuyvers, Soeng, Plasmans, and Van Den Bulcke, 2011; Tahir and Chen, 2011; Kang and Jiang, 2012; Saini and Singhania, 2018). The location-specific advantages identified four motives of multinational enterprises (MNEs) to invest abroad; market-seeking, resource-seeking, efficiency-seeking, and strategic asset-seeking motives, or generally regarded as the traditional economic factors (Kang and Jiang, 2012).

2.4 Empirical Literature

Empirically, a number of literatures have observed that some resource-abundant countries attract less FDI than other countries which are resource-poor countries (Asiedu, 2013; Poelhekke & Van der Ploeg, 2010, 2013). There is a widespread idea that countries rich in natural resources such as oil, gas, diamonds or gold, motivate more FDI, but this is not always the case. The impact of natural resources on FDI is still a controversial issue, with evidence of inducing positive and negative effects. Bokpin, Mensah, and Asamoah (2015) noted that countries that rely heavily on extractive industries have seen large increases in natural resource rents, but their growth will not be sustainable unless they invest in productive assets

Kinoshita and Campos (2003) investigated the determinants of FDI inflows to 25 transition economies between 1990 and 1998 using unique panel data; this study concludes that natural resources are the key factor for attracting FDI to this area along with institutions, openness and agglomeration. Asiedu (2006) revealed that, mineral and oil exports; total exports ratio as a proxy of natural resource, has a significant role in attracting FDI inflows, taking 22 African countries as a sample during (1984-2000) and using panel data analysis. In the same line, in 45 African countries, Hailu (2010) examined the demand side factors affecting foreign capital inflows over the period 1980 and 2007. The study found that natural resource (mineral depletion as a share in GNI) is positively and significantly correlated with FDI ratio.

Poelhekke and van der Ploeg (2010) examined whether natural resources attract FDI; covering outflows FDI from Dutch firms to 183 countries for the years 1984-2002, applying a gravity panel data model. By differentiating between FDI outflows to resource sectors and non-resource sectors, they established two econometric models one for resource FDI and another for non-resource FDI. Their estimations showed that subsoil assets as a proxy of natural resources induce an adverse impact on non-resource FDI, but have a positive effect on resource FDI. Also, they found that the net effect of resource abundance on total FDI quickly becomes negative using a simulation exercise (FDI become negative four years after shock in Australia whereas it became negative two years after shock in Norway). One of the surprising results is that institutional quality and trade openness have no significant effects on FDI in the non-resource sector while the institutional quality does have a positive role on resource FDI.

Asiedu (2013) study contradicts her earlier study in 2002. Asiedu (2013) revealed a negative connection between natural resources (defined as the share of fuel exports in total reports and oil rents-GDP ratio). She used the GMM method to regress net FDI inflows; GDP ratio on natural resources, institutional quality and some control variables like trade openness, inflation and GDP per capita in 99 developing countries during 1984-2011. Asiedu (2013) results illustrate that natural resource have a negative effect on FDI by 0.05. This result was consistent with Poelhekke and van der Ploeg (2010, 2013), but Asiedu (2013) concluded that high quality of institutions could mitigate the adverse influence of natural resources and criticised Poelhekke and van der Ploeg (2010, 2013) conclusions by using a variety of different measures of institutional quality. Asiedu (2013) described this negative relationship as a crowding out effect.

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A number of studies have found positive effect of human capital on FDI inflows (Rodriguez and Pallas, 2008; Naanwaab and Diarrassouba, 2016; and Alarcon-Osuna, 2016), while others found negative influence (Urata and Kawai, 2000; and, Gorg and Greenaway, 2002). Another set of studies detected either positive or negative effect, depending on the choice of proxy for human capital (e.g. Petrovic-Randelovic et al., 2020). Insignificant effect was found by Alsan, Bloom and Canning (2006), Majocchi and Presutti (2009) and Miningou and Tapsoba (2017). Other results were found by Kheng, Sun, and Anwar (2017) (bidirectional causality) and Kar (2013) (weak unidirectional causality from FDI to human capital). The diversity of results is to be expected because FDI is determined by a large number of factors, making the results sensitive to the selected set of explanatory variables, which forms the basis of the Leamer (1983) critique of the use of multiple regressions to derive inference. Furthermore, confirmation bias and publication bias entice researchers to be selective in choosing the set of results they report.

Rizvanolli (2012) refers to results showing that while human capital appears to be one of the most important determinants of FDI, it becomes significant only when more recent years (after 1991) are included in the sample (hence, sensitivity to the time period). Using a secondary education index to proxy the level of human capital, Cleeve (2008) reveals a less-than-conclusive relationship between FDI and human capital. Cheng and Kwan (2000) using China's regional-level data showed that the quality of labour does not have any explanatory power for the regional distribution of FDI in China. Hong (2008) finds an insignificant impact of the quality of labour on the location of China's inward FDI. Cleeve, Debrah and Yihevis (2015) failed to find evidence for the role played by human capital in attracting FDI inflows to Sub-Saharan Africa.

A low inflation rate indicates a more stable economic environment, therefore higher FDI inflows (Mugableh, 2015; Williams, 2015). A number of works have been done to explore the relationship between FDI and inflation rate, and exchange rate along with other macroeconomic variables in different contexts and regions. Andinuur (2018) explore the linkages between inflation, foreign direct investment and economic growth in Ghana using annual time series data covering the period 1980 to 2011. The study employs the cointegration approach by Pesaran, Shin and Smith (2001) and the Granger causality test suggested by Toda and Yamamoto (1995) to empirically examine the relationships among the variables under consideration. The study finds that there are significant relationships among inflation, foreign direct investment and economic growth in Ghana. Inflation has a significant negative impact on FDI as well as economic growth. Economic growth has a significant positive

impact on FDI and vice versa.

Saleem et al. (2013) investigated the impact of inflation and economic growth on foreign direct investment in Pakistan using annual time series data over the period of 1990 to 2011. A multiple regression analysis was used to determine the relationship between the variables. The result reveals that both inflation and economic growth have positive relation with FDI. Ali, Faki and Suleiman (2018) examined the determinants of FDI inflows in Southern African Development Community (SADC) member countries using data for the period 1995-2016. The study employed pooled OLS as the main estimation method. Their results reveal that inflation, infrastructure, trade openness and market size are the significant determinants of FDI inflows in SADC countries. Inflation has negative impact on FDI while infrastructure, trade openness and market size are positively related with FDI. The results also show positive but insignificant effect of human capital on FDI inflows to SADC member countries.

Jahan (2020) intended to identify the underlying factors that affect the inflow of FDI to 24 emerging countries using panel data covering the period 1992-2016. The fixed effects model was chosen for this study through Hausman (1978) specification test. The empirical findings of this study demonstrate that market size, trade openness, infrastructure facilities, natural resources availability, and financial development level have significant positive effects and inflation have significant negative effects on inward FDI.

Muhammad (2020) study revealed that there exists a long-run relationship between dependent and independent variables. Inflation rate is found to have a significant negative impact on FDI in the long-run but it is insignificant in the short-run. The results also show that exchange rate has a significant positive relationship with FDI both in the long-run and short-run.

The review of both theoretical and empirical literature of the study revealed there is no consensus on the real determinants of FDI inflows. In macroeconomic theories some authors place emphasis on geography, others on institutions, interest rate and some on the macroeconomic environment. The study focused on three explanatory variables (natural resources, IT and telecommunications, and education), one control variable (inflation rate) and geographical distance from China to ascertain the root cause of Chinese FDI flow to the selected African countries of Nigeria, Kenya, Zambia, Angola, South Africa, Ethiopia, Egypt, Cameroon, Sudan, and Ghana.

3. Methodology

3.1 Nature and Type of Data

The data for the study were secondary and consisted of annual panel data of ten African countries covering the period of 2002-2021. The dependent variable was sourced from the Statistical Bulletin of China's OFDI (SBCOFDI) published by National Bureau of Statistics of China. The explanatory and control variables were sourced from: Global Competitiveness Report (GCR) published by World Economic Forum (WEF, 2021) and World Competitiveness Report (WCR) publish by Institute for Management Development (IMD, 2022).

3.2 Variables Descriptions

3.2.1 Dependent Variable

The variable used as a dependent is the stock of FDI taken to represent the inflow of a bundle of capital, technology and managerial know-how across international boundaries in search of profit. FDI is an investment made to acquire lasting interest in an enterprise(s) operating outside the investor's economy (Sothan & Zhang, 2017; and, Nangpiire, Rodrigues, and Adam, 2018). This is measured in U.S dollars and represented as the annual inflow of Chinese FDI in the sampled countries and sourced from the Statistical Bulletin of China's OFDI (SBCOFDI) published by National Bureau of Statistics of China. Based on the existing literature, the logarithm of the Chinese FDI inflow (LogFDI) is used.

3.2.2 Independent Variables

Natural Resources

Theoretically, abundance of natural resources enhances the inflows of FDI and thus, a priori expectation for this variable is $\beta_1 > 0$. This is proxied with total natural resources rents (% of GDP). Asiedu (2006) used the share of fuel and mineral exports as a measure of natural resource. This study adopted natural resources rents (% of GDP) measure.

IT and Telecommunications

Advancement in IT and telecommunications are viewed as a good influencer of FDI inflows. Theoretically, African countries with standard and well developed IT and telecommunications should attract more FDI. Therefore the a priori expectation for this variable is $\beta_2 > 0$. This variable is proxied with the number of telephone line per 100 persons (Asiedu, 2006).

Education

Foreign investors are more concerned with the quality of the labor force. The quality of labor force could help cost minimization objectives. They are more likely to invest to locations where there is quality of human capital resources. The effect of labour force quality on FDI could be positive. Therefore the a priori expectation for this variable is $\beta_3 > 0$. This variable is proxied with labor force participation rate, total (% of total population ages 15-64).

3.2.3 Control Variable

Inflation Rate

Inflation rate represents the changes in the general price level. In many empirical studies, inflation rate is used as a proxy for macroeconomic stability. This has been widely acknowledged as one of the key influential factors of the flow of foreign direct investment into the host country. High inflation reduces investment in productive enterprises, thus reducing economic growth. Therefore the a priori expectation for this variable is $\beta_4 < 0$.

3.3 Model Specification

There is no uniformity of consensus about the econometric specification of the gravity model (Egger, 2002; Kalirajan, 2008; Nuroğlu & Kunst, 2013; Matyas, 1997; Baltagi, Egger, & Pfaffermayr, 2015; Bergstrand, Egger, & Larch, 2013). According to Anderson (2011), from a modeling standpoint, gravity is distinguished by its representation of economic interaction in a many country world. This distinguishing feature of gravity is due to its modularity: the distribution of goods or factors across space is determined by gravity forces conditional on the size of economic activities at each location. Modularity readily allows for disaggregation at any scale and permits inference about trade costs not dependent on any particular model of production and market structure in full general equilibrium.

The analytical foundation of this study is based on Dunning (1981) eclectic macroeconomic FDI structure and the model adopted for this study is predicated on Dinkneh & Jiang (2020), which is the modified form of the original gravity model presented by Tinbergen (1962), as presented in 3.1.

$$InY_{it} = \theta + \beta_m M_{it} + \beta_n N_{it} + \beta_o O_{it} + \beta_p P_{it} + \mu, \qquad 3.1$$

Where, Y_{it} represents FDI from China to country i in African host country at time t, M_{it} represents natural resources in African host country i at time t, N_{it} represents IT and telecommunications in African host country i at time t, O_{it} represents education in African host country i at time t, P_{it} represents inflation rates in African host country i at time t, In represents natural logarithm, θ represents the intercept or autonomous parameter estimate, β_m to β_p represents parameter estimate representing the coefficients respectively, and μ represents error term (or stochastic term). The model is used to assess the role natural resources endowment, education, infrastructure

development, and inflation rates exert on China-Africa foreign investment interactions. The model in 3.1 is thus, specified in the econometric model of 3.2 to align with the real variables of the study

$$\log CHINAFDI_{it} = \beta_0 + \beta_1 NATRES_{it} + \beta_2 ITT_{it} + \beta_3 EDU_{it} + \beta_4 INFR_{it} + \varepsilon_{it} \quad 3.2$$

The models used to establish relationships and test significance of the dependent and explanatory variables are Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE). The Hausman test conducted rejected the null hypothesis (P-value < 0.05) at 5% level of significance (See Table 4.7), and a fixed effects model selected for this study. The fixed effects model is represented as equation 3.3.

$$Y_{it} = \beta_0 + \beta_1 X_t + \varepsilon_{it} \quad 3.3$$

4. Results and Discussion

4.1 Results and Findings

To explain the area graphs of (figure 4.1) the panel data between the periods, this study used table 4.1 and 4.2 respectively.

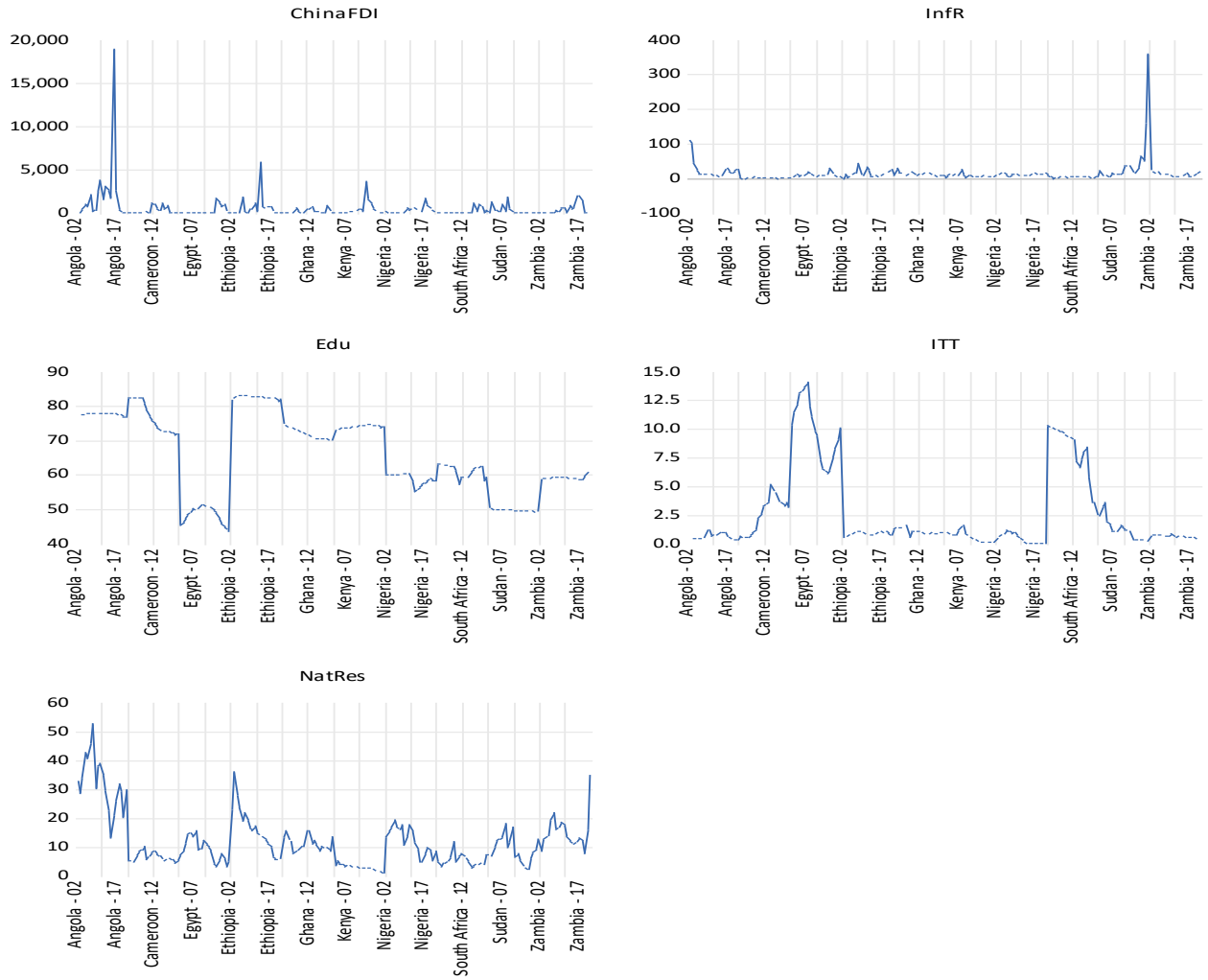

Figure 4.1: Average Values of Dependent and Independents Variables

Source: Author's Computation using E-views 12 output

Table 4.1: Average Values of Dependent and Independents Variables						
Country	Dependent and Independents Variables Selected	Chinese FDI	Natural Resources	IT and Telecommunications	Education	Inflation Rate
Angola		2130.97	32.10	0.67	77.71	26.71
Cameroon		310.44	6.62	2.63	76.81	2.17
Egypt		264.08	9.04	9.94	48.38	10.30
Ethiopia		686.41	15.94	0.83	82.66	14.66
Ghana		239.28	11.28	1.10	72.09	13.52
Kenya		458.46	2.85	0.65	74.08	8.78
Nigeria		360.12	12.09	0.45	58.86	12.29
South Africa		191.04	5.35	8.01	61.25	5.14
Sudan		301.88	9.18	1.25	49.80	46.90
Zambia		492.42	15.13	0.68	59.36	12.53
Average Overall Values		**543.51**	**11.96**	**2.62**	**66.10**	**15.30**

Source: Authors' Summary Analysis (2023)

The study revealed in figure 4.1 and table 4.1 that Angola has the best average natural resource rent (32.10% of GDP), Egypt has the best average IT and telecommunications in terms of fixed telephone subscription (9.94 per 100 people), Ethiopia has the best average labour force participation rate, total (82.66% of total population ages 15-64), and Cameroon has the least average inflation, consumer price (annual 2.17%). On the other hand, Kenya has the worst average natural resource rent (2.85% of GDP), Nigeria has the worst average IT and telecommunications in terms of fixed telephone subscription (0.45 per 100 people), Egypt has the worst average labour force participation rate, total (48.38% of total population ages 15-64), and Sudan has the highest average inflation, consumer price (annual 46.90%). Table 4.2 presents the distance between mainland China and the selected African countries.

Table 4.2: Distance Between China and Selected African Countries					
Air Travel (Miles)		Overall Mean Distance (OMD)		5,677	
Physical Distance (Km)		Overall Mean Distance (OMD)		9,136	
Actual Distance (AD)					
Country	**Actual Distance Between Countries**	**Air Travel (Miles)**	**Criteria**	**Physical Distance (Km)**	**Criteria**
Angola		6,467	AD > OMD	10,407	AD > OMD
Cameroon		6,029	AD > OMD	9,703	AD > OMD
Egypt		4,285	AD < OMD	6,896	AD < OMD
Ethiopia		4,384	AD < OMD	7,056	AD < OMD
Ghana		6,741	AD > OMD	10,848	AD > OMD
Kenya		4,905	AD < OMD	7,894	AD < OMD
South Africa		6,974	AD > OMD	11,224	AD > OMD
Sudan		4,814	AD < OMD	7,748	AD < OMD
Nigeria		6,164	AD > OMD	9,920	AD > OMD
Zambia		6,005	AD > OMD	9,664	AD > OMD

Source: Author's Computation (2023)

The study revealed that, Egypt, Ethiopia, Kenya and Sudan are closer to China both in terms of air travel and physical distance. On the other hand, Angola, Cameroon, Ghana, South Africa, Nigeria and Zambia are farther from China both in terms of air travel and physical distance. Tables 4.1 and 4.2 revealed that, Angola, the third

farthest from China, recorded the highest average Chinese FDI inflows of 2,130.97 million dollars during the study period. South Africa, the farthest from China, recorded the worst average Chinese FDI inflows of 191.04 million dollars during the study period. On the other hand, Egypt, the closest to China was the eight preferred destination of Chinese FDI flow. Thus, the study concludes that, geographical distance does not play a key role in determining Chinese FDI inflows as predicted by Internalization theory; that market-seeking firms are more likely to serve geographically proximate countries through exports and more distant markets via FDI (Buckley & Casson, 1981). Table 4.3 presents the summary of descriptive statistics of the variables included in the model.

Table 4.3: Panel Summary Statistics of variable

Variable	CHINAFDI	EDU	INFR	ITT	NATRES
Mean	543.5098	66.09845	15.30015	2.626513	11.95919
Median	126.6130	66.67750	10.01801	0.966322	9.774625
Std. Dev.	1525.719	11.68853	29.65341	3.502854	9.235500
Skewness	9.341296	-0.152150	8.773900	1.688875	1.739529
Kurtosis	109.7543	1.713464	95.25541	4.572442	6.303507
Jarque-Bera	97879.38	14.65478	73491.55	115.6815	191.8083
Prob.	0.000000	0.000000	0.000000	0.000000	0.000000
Observation	200	200	200	200	200

** Represents Non-log Variables

Source: Authors' Computation using E-views 12 output

It can be seen that variability is higher in the dependent variable CHINAFDI, as indicated by a standard deviation of 1525.719 and there is greater difference in CHINAFDI among the selected African countries for the period under study. Also, variability was higher in the explanatory variables as indicated by a standard deviation; ITT has the lowest variability of 3.502854, while INFR has the highest variability of 29.65341. Furthermore, CHINAFDI, INFR, ITT, and NATRES are positively skewed while EDU is negatively skewed. The results revealed EDU is platykurtic (fat or short-tailed) variable; with value of kurtosis 1.713464 < 3, while, INFR, ITT and NATRES were leptokurtic (slim or long tailed) variables; with kurtosis values > 3. Jarque-Bera test revealed the residuals are not normally distributed since the probability values do not exceed 5%. Additionally, before conducting the regression analysis, the study conducted a diagnostic test to check for the presence of multicollinearity between all pairs of variables. The summary statistics (Correlation Matrix) is presented in table 4.4.

Table 4.4: Descriptive Statistics: Correlation Matrix

Correlation	CHINAFDI	INFR	EDU	ITT	NATRES
CHINAFDI	1.000000				
INFR	-0.007494	1.000000			
EDU	0.152395	-0.120846	1.000000		
ITT	-0116161	-0.157820	-0.450852	1.000000	
NATRES	0.180303	0.130937	0.268660	-0.242891	1.000000

** Represents Non-log Variables

Source: Author's Computation using E-views 12 output

Table 4.4 results revealed the strongest correlation observed is between EDU and NATRES at 0.268660. The outcome showed no significant correlation among the explanatory variables. Thus, the regression model was free of multicollinearity problems and all explanatory variables included in the regression analysis. To avoid false regression, the stability of the panel data was verified before the regression analysis. The Levin, Lin and Chu (2002), Im Pesaran and Shin (1997), ADF and Maddala and Wu (1999) tests were conducted on the variables and

the results presented in Table 4.5.

Table 4.5: Summary of Panel Unit Test Results

	At level				At first difference			
Variables	Levin, Lin & Chu t*	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-square	PP-Fisher Chi-square	Levin, Lin & Chu t*	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-square	PP-Fisher Chi-square
CHINAFDI	-1.58	-2.12**	31.31**	62.93**	-6.67**	-7.51**	90.77**	490.89**
INFR	-6.722**	-4.84**	79.59**	67.69**	-7.59**	-7.72**	104.94**	443.04**
EDU	-2.47**	-1.31**	33.67**	18.54	-0.71	-0.92	37.70**	85.53**
ITT	-1.17	0.22	18.02	13.87	-4.79**	-4.87**	63.75**	190.08**
NATRES	-2.42**	-1.16	24.26	21.59	-1.16	-5.96**	72.46**	177.29**

*****Indicates statistically significant at 5% level of significance (Test critical values at 5% level of significance).

Source: Constructed by Author using E-views 12 output

Table 4.5 results revealed not all variables were stationary at level 1 (0). The four tests revealed ITT was not stationary at level. The IPS, ADF-Fisher, and PP-Fisher show NATRES was not stationary at level. The LLC and PP-Fisher test revealed CHINAFDI and EDU respectively were not stationary at level 1 (0). The test results after first differencing revealed all variables not stationary at level 1 (0) were all integrated of order 1 or are 1 (1) series. The unit root results were mixed and thus, this study emphasized the results of PP-Fisher (Maddala & Wu, 1999). The unit root tests revealed that, some economic series have unit roots and cannot be directly employed for empirical analysis without differencing (Granger & Newbold, 1974). The study examined the long-term relationship among the integrated variables using the Kao (1999) cointegration technique with result presented in table 4.6.

Table 4.6: Summary of Panel Unit Cointegration Results

Estimates	t-Statistic	Prob.
ADF	-1.783124	0.0373
Residual Variance	2.015839	
HAC Variance	1.551002	

Source: Constructed by Author using E-views 12 output

The outcome on table 4.6 showed that, at the significance level of 5%, the panel ADF rejects the null hypothesis (p-value < 0.05) within the dimension of the panel Kao statistics indicating panel cointegration relationship exists. Thus, the stationary variables and specified model were used for the study.

Random-Fixed Effect Selection Test

The appropriate model used was selected on results from Hausman test. This study result is presented in table 4.7

Table 4.7: Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross-section random	23.653943	4	0.0001

Source: Constructed by Author using E-views 12 output

The result presented in table 4.7 revealed the null hypothesis is rejected (P-value < 0.05) at 5% levels of significance. The coefficient of determination, R-squared (0.28) indicates that the explanatory and control

variables; NATRES, ITT, EDU and INFR, explain 28% of the variation in the dependent variable; FDI from China, to the selected African countries. The study reported findings for the pooled OLS, fixed and random effect models for comparison purposes and to allow for robustness of results.

Table 4.8: Fixed and Random Effects Regression Results

Variables	(1) Pooled OLS	(2) Fixed Effects	(3) Random Effects
Constant	5.65**	23.82**	5.90**
	(0.00)	(0.00)	(0.00)
INFR	-0.02**	-0.02**	-0.02**
	(0.00)	(0.00)	(0.00)
EDU	-0.01	-0.28**	-0.02
	(0.34)	(0.00)	(0.31)
ITT	-0.20**	-0.27**	-0.21**
	(0.00)	(0.02)	(0.00)
NATRES	0.05**	-0.01	0.04**
	(0.00)	(0.66)	(0.01)
Observations	200	200	200
R-squared	0.16	0.28	0.14
Hausman test	23.65**		
P-value	0.0001		

* Significant at 1%, ** Significant at 5%, *** Significant at 10%

Source: Constructed by Author using E-views 12 output

The regression results are presented in table 4.8, which reports the estimated coefficients on the four variables representing education (human capital), inflation rate, infrastructure development, and natural resources. The results include the percentages of negative, positive, significantly negative and significantly positive coefficients.

The coefficient of inflation rate (INFR) is negative and significant in the pooled OLS, fixed effects and random effects models. This outcome is in line with theoretical expectation and the discussed literature (Andinuur, 2018; Ali, Faki and Suleiman, 2018; Jahan, 2020, and Muhammad, 2020).

The coefficient of education (EDU) is significant in the fixed effects model. This is in line with the discussed literature (Rizvanolli, 2012). The coefficient is negative in the pooled OLS, fixed effects and random effects models. This also, is in line with the discussed literature (Urata and Kawai, 2000, and Gorg and Greenaway, 2002). Furthermore, and in line with the discussed literature (Alsan, Bloom and Canning, 2006; Majocchi and Presutti, 2009, and Miningou and Tapsoba, 2017), the outcome was not significant in the pooled OLS and random effects models.

The coefficient of IT and telecommunications (ITT) is significant in the pooled OLS, fixed effects and random effects models. This outcome is in line with theoretical expectation and the discussed literature (Gani and Sharma (2003). The outcome has a negative relationship with FDI from China. This outcome is in line with the studies of Gholami, Lee and Heshmati, (2005).

The coefficient of natural resources (NATRES) is positive and significant in the pooled OLS and random effects models. This outcome is in line with theoretical expectation and the discussed literature (Asiedu, 2006, and Hailu, 2010). The coefficient for the fixed effects model is negative, which is in line with the discussed literature (Poelhekke and van der Ploeg, 2010, 2013, and Asiedu, 2013), but not significant.

4.2 Discussion of Results

South Africa, the farthest sampled African country from China recorded the worst average Chinese FDI inflows of 191.04 million dollars during the study period. On the other hand, Egypt, the closest to China recorded an

average Chinese FDI inflow of 264.08 million dollars during the same period. The country with the highest average Chinese FDI inflows is Angola which recorded 2,130.97 million dollars and happened to be the third farthest from China. The study outcomes negate Internationalization theory, that market-seeking firms are more likely to serve geographically proximate countries through exports and more distant markets via FDI (Buckley & Casson, 1981). Thus, the study concludes that, geographical distance does not play a key role in determining Chinese FDI to the selected African countries

The study result revealed Angola has the best average natural resource rent (32.10% of GDP) followed by Ethiopia (15.94% of GDP), Zambia (15.13% of GDP) and Nigeria (12.09% of GDP). Angola is the most preferred destination of Chinese FDI (2,130.97 million dollars) followed by Ethiopia (686.41 million dollars), and Zambia (492.42 million dollars). These analyses support empirical results of the pooled OLS and random effects where coefficients of natural resources have a positive and significant impact on Chinese FDI inflows. The outcome is in line with theoretical expectation and the discussed literature (Kinoshita and Campos, 2003; Asiedu, 2006, and Hailu, 2010). However, Kenya with the worst average natural resource rent (2.85% of GDP) became the fourth preferred destination of Chinese FDI (458.46 million dollars). This supports empirical result of the fixed effects model where natural resources exert insignificant impact on Chinese FDI inflows. The relationship is negative and in line with the discussed literature (Poelhekke and van der Ploeg, 2010, 2013, and Asiedu, 2013).

The study result revealed Egypt has the best average IT and telecommunications in terms of fixed telephone subscription (9.94 per 100 people) followed by South Africa (8.01 per 100 people), Cameroon (2.63 per 100 people), and Sudan (1.25 per 100 people). Egypt is the eight preferred destination of Chinese FDI inflows (264.08 million dollars) and South Africa the worst preferred destination of Chinese FDI inflows (191.04million dollars). These analyses support empirical results of the pooled OLS, fixed effects and random effects where coefficients of IT and telecommunications have a negative and significant influence on Chinese FDI inflows. A 1% improvement in IT and telecommunications will cause a 0.02% decrease in Chinese FDI inflows. This outcome is in line with theoretical expectation and the discussed literature (Gholami, Lee and Heshmati, 2005).

The study result revealed Ethiopia has the best average labour force participation rate, total (82.66% of total population ages 15-64) followed by Angola (77.71% of total population ages 15-64), and Cameroon (76.81% of total population ages 15-64). Angola (2,130.97 million dollars) and Ethiopia (686.41 million dollars) are the most preferred destination of Chinese FDI inflows. These analyses support empirical result of the fixed effects model where education (labour force participation) exerts negative and significant influence on Chinese FDI inflows. A 1% decrease in labour force participation rate reduces Chinese FDI inflows by 0.28%. This is in line with the discussed literature (Rizvanolli, 2012). The coefficient is negative and not significant in the pooled OLS and random effects models. This is in line with the discussed literature (Urata and Kawai, 2000, and Gorg and Greenaway, 2002) and (Alsan, Bloom and Canning, 2006; Majocchi and Presutti, 2009, and Miningou and Tapsoba, 2017) respectively.

The study result revealed Cameroon has the least average inflation, consumer price (annual 2.17%) followed by South Africa (annual 5.14%), Kenya (annual 8.78%), and Egypt (annual 10.30%). Kenya (458.46 million dollars) is the fourth preferred destination of Chinese FDI inflows. These analyses support empirical results of the pooled OLS fixed effects and random effects models where coefficients of inflation rates negatively and significantly impact on Chinese FDI inflows. A 1% drop in inflation rate will increase Chinese FDI inflows by 0.02%. This outcome is in line with theoretical expectation and the discussed literature (Andinuur, 2018; Ali, Faki and Suleiman, 2018; Jahan, 2020, and Muhammad, 2020). On the other hand, Sudan has the highest average inflation, consumer price (annual 46.90%) followed by Angola (annual 26.71%), and Ethiopia (annual 14.66%). Angola (2,130.97 million dollars) and Ethiopia (686.41 million dollars) are the most preferred destination of Chinese FDI inflows. This outcome is in line with Saleem et al. (2013) study where inflation rates were found to have a positive relationship with FDI.

5. Conclusion

The study have empirically examined China FDI to African countries; the role of natural resources, education, inflation rates and infrastructure development. This study used panel data for the period 2002 to 2021 (T=20, N=4). The first stage in evaluating the empirical results was to check for spurious regression. This was done by

applying panel data unit root tests. This study used four different panel unit root tests. They are Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), Augmented Dicky Fuller (ADF) and Phillips-Perron (PP). As a result of the panel unit root tests, the study applied Kao panel co-integration tests in order to make sure that there is a long-run relationship between the variables of the model. The Hausman test revealed the fixed effect model was appropriate for estimation. The fixed effects model controls for the expected heterogeneity between countries.

The results revealed a negative and insignificant relationship between natural resources and FDI (China FDI). This outcome is in line with the discussed literature (Poelhekke and van der Ploeg, 2010, 2013, and Asiedu, 2013). Asiedu (2013) used oil exports as a proxy for natural resources while Poelhekke and Van der Ploeg (2013) measure natural resources by oil assets. However, this study used natural resource rents as a proxy for natural resource abundance. The study concludes that, abundance of natural resources play a key role in attracting Chinese FDI inflows. This is based on Angola with the best average natural resource rent attracting over 27.69% of total Chinese FDI flow to African countries. Also, Nigeria, Sudan, and South African are the most preferred destination of Chinese FDI in their sub-African regions.

The fixed effects model revealed that the usual determinants of FDI such as education (labour force participation rate), IT and telecommunications, and inflation rate have negative and significant relationship with Chinese FDI inflows.

Education (human capital) is discovered to play a significant role in attracting Chinese FDI inflows which is line with the work of Rizvanolli (2012). This relationship was found to be negative and in line with the discussed literature (Urata and Kawai, 2000, and Gorg and Greenaway, 2002). The study concludes that, the greater the labour force participation rate is, the more likely it is that Chinese FDI will be attracted in the long run. By implication, China FDI flows are skewed in favour of African countries with high labour force participation rate. This is based on Angola and Ethiopia with the better average labour force participation rate attracting greater Chinese FDI inflows. Intuitive arguments can be presented as to why human capital in the host country may have a positive, negative, significant or insignificant effect on FDI inflows. The empirical literature provides evidence for all of these possibilities, the dominant reporting of positive effect may be motivated by research selection bias which is what triggered the Leamer (1983) critique.

IT and telecommunications is found to have a negative and significant relationship with Chinese FDI inflows to the selected African countries. This outcome is in line with theoretical expectation and the discussed literature (Gani and Sharma, 2003 and Gholami, Lee and Heshmati, 2005). The study concludes that the greater the level of IT and telecommunications is, the less likely it is that Chinese FDI will be attracted in the long run. By implication, China FDI flows are skewed in favour of African countries in need of critical infrastructures. This is based on Nigeria, Kenya, Angola, and Zambia with poor average IT and telecommunications attracting far greater Chinese FDI than Egypt and South Africa with the better average IT and telecommunications.

Inflation rate have a negative and significant relationship with Chinese FDI inflows to the selected African countries. This outcome is in line with theoretical expectation and the discussed literature (Andinuur, 2018; Ali, Faki and Suleiman, 2018; Jahan, 2020, and Muhammad, 2020). High inflation rates tend to check the export performance of domestic and foreign investors and thereby discourage export-oriented FDI by increasing the prices of locally sourced inputs, making it harder to maintain a cost advantage in third markets. Ordinarily, a low inflation rate indicates a more stable economic environment, therefore higher FDI inflows (Mugableh, 2015; Williams, 2015). The study concluded that, with China, inflation rate is a key determinant of FDI flow to African countries in the long run. This is based on Sudan with the highest average inflation rate attracting lower Chinese FDI inflows relative to six out of the ten selected African countries with better inflation rates.

China's non-interference policy that separates business from politics has led critics to accuse China of going after economic benefits at the expense of democracy and human rights. This study revealed that, selected African countries with natural resources endowment, high labour participation rates, poor critical infrastructures and good trade tie with China are likely to attract more Chinese FDI inflows. Also, sound macroeconomics conditions such as low inflation rates are key to aiding better China-Africa investment interactions in the long run. Arguably, while the analyses here offer some insight into the determinants affecting Chinese FDI inflows to the selected African countries, further study using different set of proxies and methodologies is warranted to broaden understanding of

the nature and the implications of the China-Africa investment interactions.

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