Institutional distance and Chinese investment efficiency in Africa: a stochastic frontier analysis

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Abstract

Purpose – This study aims to analyse the efficiency effects of institutional distance on Chinese outward foreign direct investment (FDI) in Africa.

Design/methodology/approach – The study utilised the true fixed-effect stochastic frontier analysis (SFA) model. Data from 2003 to 2016 (14 years) were acquired from 42 targeted African countries, which are included in the analysis.

Findings – The results reveal that FDI flow efficiency can be maximised with a high institutional distance between China and African countries. Contrariwise, comparable institutional distance, measured by the rule of law, regulatory quality and government effectiveness between the host and home countries, reflected a significant positive impact for Chinese outward foreign direct investment (OFDIs), indicating Chinese MNEs can invest directly in a country with comparable institutional characteristics.

JEL Classification — F21, O43, E02

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Compliance with ethical standards

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Originality/value – There have been limited exceptional studies that assessed the effect of institutional distance between emerging countries. However, none of these studies investigated the effect of institutional distance between China and Africa at a national level. Using the advantage of the SFA model, this study assesses the efficiency effects of institutional distance between the host and home country.

Keywords Africa, China, Direct investment, Efficiency, Institutional distance, Outward foreign direct investment (OFDI), Stochastic frontier model

Paper type Research paper

Introduction

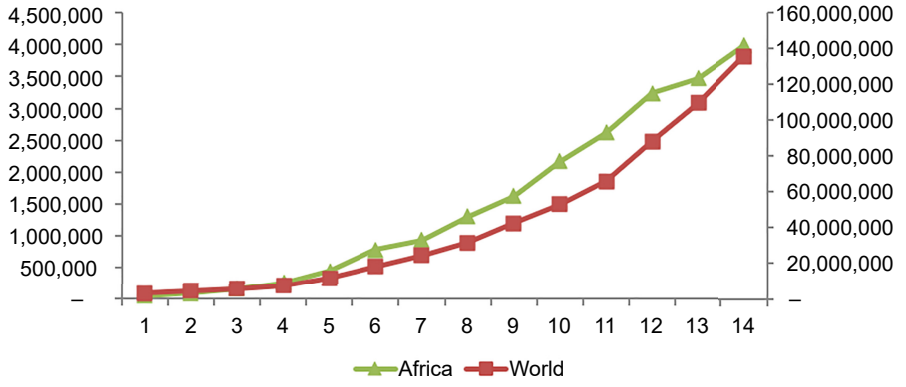
Developing countries' foreign direct investment (FDI) increased to reach their highest level at $681 billion with a 2% rise in 2014 (UNCTAD, 2015). Correspondingly, Chinese OFDI stock in Africa grew to US$26.2 billion in 2013 from US$1.6 billion in 2005 (Bräutigam and Tang, 2014). The Chinese commitment to the African continent in terms of capital flows containing FDI, development collaborations, aid, and reciprocal relations consistently intensified for most recent periods. Numerous studies identified China's "Go Global Policy" that encourages Chinese multinational enterprises (MNE) to pursue foreign ventures (Bräutigam and Tang, 2014; Buckley *et al.*, 2016; Kaplinsky and Morris, 2012). This increased China's OFDI approximately 20 times during the past ten years (Chen, 2018). The One Belt, One Road (OBOR) Initiative represents the continuing and deepening of the "Go Global Strategy", which has increased investment in Africa through its Maritime Silk Road initiative, targeting the expansion of investments and infrastructure developments in OBOR countries. Driven by such initiatives and strategies, China, in a span of 16 years, has increased investments in Africa, surging the FDI flow from US$75 million in 2003 to US$5.4 billion in 2018 (Johns Hopkins University SAIS China–Africa Research Initiative, 2021). Also, the annual average growth rate of Chinese OFDI increased by 37.5% for a continuous 12-year period, reaching a historical maximum of US$123.12 billion in 2014 (Du *et al.*, 2018). Hence, for the first time in history, China became the world's leading external investor by 2016, while the global OFDI decreased by 7% (US$1,625 billion) compared to US$549 billion in 2015 (OECD, 2016).

Currently, with its increasing trade surplus and excessive reserves, China is emerging as a capital provider for the industrialised world, as well as a major investor in developing countries, particularly in countries—including Africa—traditionally perceived as risky and not generally favoured by Western investors. With China's continuing deregulation of investment protocols via measures such as its "Go Global" initiative, OFDIs are likely to increase further in African countries, according to China's Yearly Statistical report (see Figure 1).

The gradual surge of China's OFDI in Africa over the last few years has prompted some debate. While some commentators magnify China's growing engagement in Africa, others challenge the motives underlying these investments and the implications for Africa's political and economic development. Consequently, the effects of investments in aid received and highly indebted African countries have prompted a global frontier of research (Paul and Benito, 2017; Liu *et al.*, 2022), with some research focusing on identifying the determinants of FDI movements (Fourie and Burger, 2009; Mourao, 2018).

Regarding investment destinations, countries frequently establish capital allocation decisions in relative terms, while literature identifies the resource advantage, locations, rate of return, and patents.

One such study clarified the rationale behind Chinese investments, including gaining access to managerial skills, advanced technology, and resources (Zhang and Daly, 2011). Currently, technological advancements are decreasing the effects of observed costs of investment, creating undetected costs regarding institutional distance, which prompted substantial contemporary research (Guo, 2004; Linders *et al.*, 2005; Tadesse *et al.*, 2017).



Source(s): OECD, 2016

Figure 1.
The stock of OFDI to African countries

This is particularly noticeable in Chinese investments with certain characteristics related to Africa's political and institutional qualities (Lu *et al.*, 2017; Mourao, 2018).

This study also contends that the choice of the host country, in terms of institutional distance, must be matched to establish the legitimacy of the foreign subsidiary in the host country to ensure the transfer and sustainability of competitive advantage are safeguarded. Once a host country is identified, entry approaches and strategies must be harmonised with institutional distance to the hosting country to augment competitive advantages resulting from either a small institutional distance or the ability to mitigate the negative impact of a large distance. To date, research focusing on identifying the determinants of FDI movements in emerging countries often neglect institutions' distance, while plausible empirical assessments designed to test these issues have been too limited to provide conclusive results on Chinese investments (Fourie and Burger, 2009; Mourao, 2018). Overall, only three unique studies have assessed the effect of institutional differences between host and home countries regarding FDI flow (Buckley *et al.*, 2016; Che *et al.*, 2017; Li *et al.*, 2018). Buckley *et al.* (2016) included institutional factors of both China and the host countries to examine the effect of institutional characteristics on cross-border mergers and acquisitions. The study determined that Chinese MNEs were "short sighted" and, thus, reflected adverse impacts concerning host country risk when determining the location of the host country and volume of investments undertaken through cross mergers and acquisitions, which may damage the firm's long-term profitability.

Similarly, Li *et al.* (2018) assessed institutional differences and Chinese OFDIs in 150 countries. They identified that the institutional differences of government effectiveness and control of corruption between China and a host country have a statistically significant negative effect on China's OFDI. Additionally, the study inferred that the OBOR policy did not, at the time, have the anticipated positive effect on China's OFDI, whereas Che *et al.*'s study (2017) explored the relationship between institutional distance (ID) and Foreign Invested Enterprises (FIEs) as a proxy of inward FDI in China and identified FDI derived from countries with better institutions than China are sensitive to Chinese regional institutional distance. However, none of these studies investigated the effect of institutional differences between China and Africa at a national level. Thus, the impact of institutional distance on OFDI movement from China to African countries can be considered timely and necessary for academia and policymakers.

Therefore, this study assesses the effect of institutions' distance on Chinese OFDIs using the SFA model. Thus, the findings of this study are expected to fill the literature gap by

examining the efficiency effects of the institutional distance of the 42 selected African countries (Table 5). The study proceeds as follows: section two provides a literature review of the research, critically examine the theories and frameworks dealing with FDI, and the extent to which researchers can rely upon their research concerning OFDIs from emerging countries. Section three comprises the methodology and the study's data source. Section four reports on the detailed analyses and discussions, while section five presents the conclusions from the study.

Literature review

Nexus between FDI and institution – theoretical underpinning

Scholars developed competent theories on the engagement of MNEs and clarified the effects, determinants, and characteristics of investments (Dunning, 1988; Dunning and Rugman, 1985; Johanson and Vahlne, 1977). With this, over the past decades, relationships between OFDI and institutions have been intensively analysed. Numerous theories hypothesised the nexus, effect, and movement between economies (Paul and Feliciano-Cestero, 2021). Nevertheless, identifying the rationale for the growth and influx of FDI to a region was not simplistic as it depends upon a wide range of factors (Levinthal, 2016). Different frameworks (neoclassical, monetary, transaction costs, portfolio theory) have evolved to analyse the determinants and effects of FDI, the flexible and more important aspect is the "eclectic theory" (Dunning, 1980). This theory is strongly linked with ownership, location, and internalisation (OLI) (Dunning, 1988; Dunning and Dunning, 2006), which provides relative advantages for MNCs concerning superior technologies, patents, trade secrets, brand names, management techniques, and marketing strategies. As per this theory, FDI is determined by three sets of investment advantages. The first is related to ownership advantage in the host country (i.e. a firm benefit in terms of its trademark, patent or knowledge of technology or marketing). The second advantage is related to the location, which provides an important comparative advantage to operate in a particular location outside the investor's home country. This advantage may also be derived from the host country's transaction cost advantage, including the absence of a tariff on products. Studies indicate that the provision of incentives (i.e. tax incentives and subsidies) and the adoption of FDI-stimulating policies stem from the expectation that FDI will deliver substantial benefits to recipient countries (Dunning, 1980). Third is the internationalisation advantage (i.e. why a "bundled" FDI approach is preferred to "un-bundled" product licensing, capital lending, or technical assistance); however, it is difficult to explain with eclectic and OLI theories. Contrary to the theories, Chinese firms' aggressive international expansion seems to work exceptionally well despite their weaker firm-specific ownership advantage (the advantage to acquire technologies, marketing capabilities, brand equity, research and development intensity, and management competencies) in Africa.

To unravel the conundrum of investment from emerging countries, including China, Paul and Benito (2017) reintroduced Dunning's (1988) OLI into debates involving FDI and MNE's investment strategies. However, regardless of the suitability of the OLI framework, Dunning and Dunning (2006) admitted the uniqueness of OFDI from emerging countries and requested a revised theory most suitable to the economies' context. Accordingly, the international business theory recommended the internationalisation process for firms from emerging countries, such as China, to consider domestic institutional factors as the role of the Chinese government in promoting MNEs going global (Child and Rodrigues, 2005). More recently, the study of Meyer and Thaijongrak (2013) also identified the Uppsala model of Johanson and Vahlne (1977) as inadequate to explain FDI from China due to its risk aversion tendencies and gradual commitment modes. These essentially reflect the institutional entrepreneurship of Chinese MNEs in selecting investment destinations (Deng, 2013).

Additionally, Yao and Salim (2020) identified important features of state policies in China's international expansion. Such state interference poses a challenge to the existing MNE and FDI theories of Dunning and Lundan (2008), Gastanaga *et al.* (1998) and Sun *et al.* (2012). Specifically, the Chinese government's aid policy has unquestionably provided a unique advantage to some Chinese MNEs as it may have permitted them to outbid their contenders and advance their influence and export markets in Africa. Nevertheless, contemporary FDI theories have not developed a competing theory that clarifies MNEs' shifting strategies and adaptability, particularly in fragile states.

Currently, the widely deployed research theory for FDI involving emerging countries is the institutional theory (Li *et al.*, 2018; Dacin *et al.*, 2002; Auer, 2022). This theory identifies the home and host countries' institutions dictating FDI (Buckley *et al.*, 2016; Cezar and Escobar, 2015). Similarly, both Che *et al.* (2017) and Deng (2004) substantiated the institutional theory's advantage in clarifying the effect of government involvement in the internationalisation process of firms in emerging countries. Moreover, Acemoglu and Robinson (2008) substantiated the importance of strong institutions for the prosperity of countries. Institutional features that determine the investment setting can have pronounced effects when compared to traditional factors, such as natural resources or financial services (Scherr, 2004). Ambiguous regulatory laws and regulations create unintended expenses that significantly limit investment opportunities and delay business activities that frequently lead to withdrawal of investments. As Sachs and Warner (1996) and Morisset (2000) posited, established political institutions provide superior attractiveness for most MNCs. According to the study of Morisset (2000), established political institutions form political influences and mutual collaborations between governments and economies reduces risks associated with uncertainties in a host country. However, uprisings or instability diminish the prospect of an investment flow to that country. The study also indicates how distinct set of rules and regulations, enable MNCs to gain a clearer understanding of the areas to decide and ensure more lucrative returns for their investments.

The Chinese government's policy to expand its economic destination reflects a political approach rather than an economic strategy that explains investment patterns and trends–Chinese MNEs have developed context-specific abilities that can easily complement to the host country's specific economic, political and institutional principle and dimensions of the host country's environment (Taussig and Delios, 2015). Hence, Chinese MNEs can extend their knowledge of business operations and institutional adjustments, to act more proactively in unstable host country's environment, and can formulate efficient methods to safeguard their interest regardless of host countries' institutional behaviour (Delios and Henisz, 2000; Tseng and Lee, 2010).

Determinants of FDI–empirical evidences

Empirical literature confirms that an increase in FDI increases the potential output of developed and developing countries' economies (Nourzad, 2007). FDI's impact on growth and development is comparative and benefits both home and host countries by transferring knowledge, skills and standards that enhances the productivity and efficiency of labour and resources (Borensztein *et al.*, 1998; Farla *et al.*, 2016; Nourzad, 2007). The flow, intensities and directions of FDI movements are determined by numerous factors, including institutions, political environment, and the economic level of countries. Studies that associate geopolitical perils and policy uncertainty with global FDI flow are not limited (Acemoglu and Robinson, 2008; Cezar and Escobar, 2015; Che *et al.*, 2017; Chen, 2018). Evidence indicates that contemporary studies have begun to consider the impact of political and institutional factors, such as military power, economic dominance, diplomatic relations, and the promotion of rule of law as major factors of FDI (Duanmu and Urdinez, 2017; Islam *et al.*, 2020). Similarly, the study of Meyer and Habanabakize (2018) identify the effect of economic and non-economic

factors, namely, market size, patent, distance, investment competitiveness, and political stability governing the flow of FDI.

Currently, economic intuitions consider the behaviour of investors and investing countries rationality when reviewing the factors of investments (Ahmad *et al.*, 2018; Meyer and Habanabakize, 2018). Accordingly, Ahuja and Novelli (2017) identified the impacts of investment decisions on access to potential resource areas, while Fourie and Burger (2009) demonstrated how issues like relative interest rates, exchange rates, return to investment, political environment and economic expectations govern investment flows between countries. A study made by Douglas (2006) also identified a higher rate of return as the obvious rationale for FDI, outpacing other forms of foreign investment. Likewise, Liu *et al.* (2020) and Khan and Khan (2019) documented the importance of the financial systems of emerging markets and low-income countries to attract FDI.

Beyond financial returns, these studies also highlight the importance of various intangible returns such as increased diversification of production, reduced risks, and more direct control of foreign investment that ensure higher productivity and FDI. Moreover, these studies indicate the role of legal environments dictating FDI to different countries. In support of this finding, Mourao (2018) identified Chinese investors' attraction to African countries' political and institutional particularities. Using stochastic frontier models, the study selected 48 African countries between 2003 and 2010 and concluded that national markets with a large population and significant forest area have a higher attraction for Chinese FDI.

Additionally, the study indicates the efficiency of this allocation can be maximised by increased political stability and regulatory quality combined with government effectiveness. The results indicate that an increase in political stability enhances Chinese investment efficiency by 0.131, and improved regulatory quality increases efficiency by 0.121. Subsequent to these findings, studies by Ahmad *et al.* (2018), Child and Rodrigues (2005) and Deng (2004) identified the following as determinant factors involving FDI flow between countries: market size; technology; labour and output costs; trade; trade barriers and deficit; economic openness; exchange rate; taxes; inflation; growth rate; and infrastructure investments. Additionally, Dogra *et al.* (2018) also identified GDP, inflation, the exchange rate, infrastructure and openness to trade as determinants of FDI in emerging nations.

Following China's Go Global policy, Chinese MNEs began making direct investments in overseas countries (Bräutigam and Tang, 2014; Duanmu and Urdinez, 2017), creating a theoretical rift in academia. The number of cross-border mergers and acquisitions by Chinese MNEs dramatically increased as the country expanded its overseas ventures (Bräutigam and Tang, 2014). The unprecedented investment expansion of Chinese MNEs has made them one of the leading global investors, prompting empirical and policy questions.

FDI and institutional distance

Healthy political institutions tend to be associated with more efficient investments and seem to reduce costs associated with institutional vices. Contrarily, in countries characterised by higher levels of corruption, investments tend to be more onerous to the median taxpayer than in a country characterised by lower levels of corruption (Owolabi, 2011). Thus, government effectiveness can be a powerful source of efficiency that can promote foreign investors to invest (Fosu, 2001). According to Morisset (2000), an effective and efficient government optimises its output given its endowments and tends to develop a clear set of rules to attract FDI selectively. Nevertheless, the effect of investment differs according to the source and receiving countries environment (Dacin *et al.*, 2002). Coupled with geopolitical threats, it is clear that policy and institutional environment uncertainty (Cezar and Escobar, 2015; Che *et al.*, 2017; Chen, 2018) in home and host countries dictate global FDI (Buckley *et al.*, 2016; Cezar and Escobar, 2015; Inekwe *et al.*, 2020).

Dacin *et al.* (2002), identifies FDI activity declining with institutional distance increases – this is evident as MNEs incur additional costs for institutional adjustments, forcing developed countries to pay unbearably high costs compared to emerging countries. Hence, a larger institutional distance between the host and home country lowers the expected OFDI flow from developed countries (Li *et al.*, 2018) to less developed countries. A study made by Cezar and Escobar (2015) corroborates that MNEs from developed countries suffer adaptation costs that lowers profits and investment motivation in emerging and developing economies. Due to this, studies contend on MNEs from emerging countries to prefer to invest in host countries with a similar institutional or cultural environment (Bräutigam and Tang, 2014; Buckley *et al.*, 2016; Li *et al.*, 2018). In this sense, Chinese MNEs are considered "short sighted" and exhibit irrational behaviour towards host country risks when deciding on the location and volume of investment (Buckley *et al.*, 2016).

A study made on China by Che *et al.* (2017) identified the role of institutional differences and investments of foreign enterprises in Chinese market. The result shows that MNEs from source countries that are institutionally better than mainland China exhibit a higher degree of sensitivity toward regional economic institutions in their choice of FDI location. Additionally, the study of Che *et al.* (2017) identifies how MNEs from countries with better institutions than China are sensitive to institutional distance with China. However, studies on Chinese FDI in emerging countries indicate the opposite result—poor institutions attracting Chinese FDI (Buckley *et al.*, 2007; Li *et al.*, 2018). These discrepancies have provided academic impute to assess the effect of institutions on the efficiency of investment return in Sub-Saharan African countries. Regardless of the theories and the existing empirical evidence, the effect of institutional quality and institutional distance of emerging economies on Chinese OFDI is inconclusive. Thus, it is crucial to fill the existing gap with empirical evidence that assesses the efficiency of investments.

Empirical methodology

Data and empirical strategy

Using STATA, the balanced panel data set consisting of 42 African countries (See Table 5) with a positive Chinese OFDI stock-flow over a period of 14 years (from 2003 to 2016) is utilised in this study. Appendix 1 contain the list of the source and details of the variables used in the analysis. The study model accommodates two categories of explanatory variables: the inefficiency/efficiency factors (Z variable), i.e. the institutional quality difference between the host and home country, hereafter referred to as the institutional distance index and the dependent and control variables of the study.

The study calculated the ID using the difference of corruption, rule of law, political instability, voice and accountability, government effectiveness and regulatory quality of the 42 African countries with China during the study period. VOICE captures perceptions of the extent to which a country's citizens are able to participate in democratic rights, such as electing their representatives, freedom of expression, freedom of association, as well as a free media. POL measures perceptions of the likelihood of political instability including politically motivated violence and terrorism. REG captures perceptions of the ability of the government to formulate and implement proper policies and conventions that allow and stimulate private sector development. RUL seizes acuities of the level to which entities have confidence in and accept and live by the rules of society, and in particular the quality of contract administration, property rights, the police, and the courts, as well as the likelihood of crime and violence. COR seizes perceptions of the level to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (Ross, 2019). These variables are used to investigate the efficiency effect of institutional distance on OFDI in Africa.

According to (Paul and Benito, 2017), OFDI can be measured in different ways, mainly via the number of units owned or subsidiaries abroad and both the flows and the stocks of FDI.

The latter two being the most commonly used OFDI measures, this study uses the Chinese OFDI stock as a dependent variable. The study used the OFDI stock to emphasise the total investment equity in the countries. The proxy indicates the amount of accumulated investment capital available in the countries. Thus, it might provide better insight compared to the standard FDI outflow which is less prevalent and fluctuate yearly.

The research also included independent and control variables commonly used in economic growth studies (Paul and Benito, 2017). This includes the percentage of resource rent (RR) to GDP, the total GDP current measured in US$, the gross fixed capital formation (GFCF), inflation (Rabkin *et al.*, 1980), per capita income (GDPP), total population (POP) and Trade (% of GDP) and (TR).

Methodological features: the stochastic frontier analysis

The most common statistical method used to assess OFDI research is regression analysis. Other frequently used statistical methods include correlation analysis, the Granger causality test, the vector autoregressive model and co-integration analysis (Paul and Benito, 2017). These indicate how scholars have used innovative and up-to-date methods to assess the trends, patterns and rationale of OFDI to different countries.

The study is motivated by the theoretical idea that no economic production can surpass the ideal "frontier", and deviations from this extreme view represent individual inefficiencies (Belotti *et al.*, 2013). The main advantage of this model over conventional regressions hinges on the unobservable resistances that affect OFDI and are captured as an inefficiency instead of an unobservable disturbance term (Albert *et al.*, 2010; Fan *et al.*, 2016; Paul and Shankar, 2018). Efficiency is the rate of observed value to potential value. In this context, measuring efficiency requires estimating the magnitude of potential values. This study considers institutional distance as an inefficiency/efficiency indicator to explain the efficiency level of Chinese FDI factors in Africa. Based on Mourao (2018), an "efficient case" does not simply mean a case of an African country attracting more Chinese FDI in absolute terms; rather, it implies that the input-output mix produces the maximal level of outputs given the inputs. Therefore, to assess the effects, the SFA model of Greene (2005) is used, following the original models of Aigner *et al.* (1977). The model has the general form:

$$OFDI_{it} = f(x_{it}\beta)\ exp\ \{\varepsilon_{it}\} \tag{1}$$

ε_{it} is the error term, which is composed of two independent elements V_{it} and U_{it}, *hence*, $\varepsilon_{it} = V_{it} - U_{it}$. V_{it} is assumed to be symmetrically, identically, and independently distributed (iid) errors that represent random variation in output and are assumed to be normally distributed with a mean of zero and a variance of σ^2.

Following Battese and Coelli (1995), U_{it} are also assumed to be non-negative random variables that represent stochastic shortfall of outputs from the most efficient production. It is assumed that U_{it} is defined by a truncation of the normal distribution of the mean and variance of σ^2;

$$\mu_{it} = \delta_0 + \sum_{j=1}^{J} \delta_j Z_{jit} \tag{2}$$

where Z_{jit} is the value of the jth explanatory variable associated with the technical efficiency of country i in year t; *and* δ_0 are unknown parameters to be estimated. The parameters of both the stochastic frontier model and the inefficiency effects model can be consistently estimated by the maximum-likelihood method (Rashidghalam *et al.*, 2016). The variance parameters of the likelihood function are estimated in terms of $\sigma^2 = \sigma_\gamma^2 + \sigma^2$ and $\gamma = \sigma^2/\sigma_s^2$. Given the

specification in Equations (1) and (2), the technical efficiency of production for the i-th country in the t-th year is defined by $TE_{it} = \exp(-U_{it})$. A test of the significance of the parameter γ is, therefore, a test of the significance of the specification of the system (Battese and Corra, 1977). The prediction of technical efficiency is based on its conditional expectation, given the observable value of $(V_{it} - U_{it})$ (Battese and Coelli, 1988).

The technical efficiency index is equal to one if the country has an inefficiency effect equal to zero; otherwise, it is less than one.

The empirical model

One of the key steps of the SFA is to choose the appropriate production function of the analysis. Regarding this choice, the study uses the Cobb–Douglas production function. We consider a model that separates inefficiency from unobserved individual-specific noise. The SFA model assumes inefficiency to be individual-specific but time-invariant, and it is random when α_i is treated as a random variable (Greene, 2005). Thus, the model can be written as:

$$y_{it} = \alpha_i + x'_{it}\beta + v_{it} - u_{it}$$

$$u_{it} = f(z)$$

$$\ln(OFDI_{it}) = \alpha_0 + \alpha_1 \ln(GDP_{it-1}) + \alpha_2 \ln(X_{it-1}) + \alpha_3 \ln(IQ_{Diff-1}) + (v_{it} - u_{it})$$

where $\ln(OFDI_{it})$ is the logarithm of Chinese OFDI stock to a host country i, $i = 1, \ldots, I$ at a period of year $t \ldots \ldots T$. x_{it} is a vector of N factors of OFDI considered for each African country at year t. $f(\cdot)$ is the function of the OFDI frontier, and β is the vector of the coefficients to be estimated. The technical efficiency of each African country i is given by TE_{it}.

The variables used in this study and their sources are presented in the attached Appendix 1. Host countries' GDP is utilised to identify the market size and market-seeking motives of investors. Different empirical studies provide evidence on the vigorous determinant effect of GDP on FDI movement (Chakrabarti, 2001), to Africa (Asiedu, 2006), and of Chinese FDI globally (Li *et al.*, 2018). Total trade proxied by the ratio of imports and exports as a percentage of total GDP is found to be a robust determinant of total FDI (Buckley *et al.*, 2007). Inflation being a measure of economic stability, it is usually involved in empirical studies of FDI. It is also an important determinant for Chinese FDI in Africa (Buckley *et al.*, 2016). Parallel to this, the study identified the importance of natural resources for the FDI in African countries. Thus, the study included the ratio of total natural resources rents to GDP in the empirical estimation. Furthermore, several empirical studies suggest the importance of institutions for FDI flows (Gani, 2007; Globerman and Shapiro, 2002; Harms and Ursprung, 2002; Wei, 2000), particularly to Africa (Asiedu, 2006). Following this, the study calculated institutional distance of China and African countries using the World Governance Indicator (WGI): corruption, rule of law, regulatory quality, government effectiveness, political stability and voice and transparency indexes.

To enhance the robustness of the results, the study also included a number of control variables that prior literature endorsed for the assessments of FDI. These include GDP per capita, gross fixed capital formation, and the total population of the receiving country. This assist to control the effects of tangible or intangible assets produced as outputs from production processes that are used repeatedly, or continuously, for more than one year, the economic muscle of individuals, and the population size of an economy.

To understand the reliability of the estimation, it is vital to check the post-estimation or diagnostic check of the SFA result using the specification of Battese and Corra (1977).

$$\sigma^2 = \sigma_u^2 + \sigma_v^2$$

$$\gamma = \sigma_u^2/(\sigma_u^2 + \sigma_u^2)$$

Results and discussions

The descriptive statistics, namely mean, standard deviation, minimum and maximum values, and the correlation between the variables, are reported in Tables 1 and 2, respectively. Resource-rich African countries comprise considerable proportions of GDP from natural resource rent, reaching 89% of their annual GDP (Abdulahi *et al.*, 2019). As per Table 1, on average, a country's resource rent account for 2.8% of its GDP, reaching a maximum of 4.1% of the total GDP. Regarding institutional quality, generally, Africa and China have a lower and comparable quality of institutions (Mourao, 2018). According to the WGI database, the institutional quality level runs from −2.5 to 2.5, −2.5 indicating the lowest quality institution, whereas 2.5 references a country's best institutional level. In both countries, the institution level is low compared to developed Western countries (Li *et al.*, 2018). Besides the statistics in Table 1, the literature also indicates a comparable and poor quality of institutions in Africa and China (Li *et al.*, 2018). Thus, institutional distance enables us to identify how Chinese MNEs respond to institutional quality (IQ) differences and the position of Chinese MNEs for Africa's IQ.

Table 2 describes the pairwise correlation of the variables and shows the general direction of the relationship between covariates, but not the causation and causal relationship between the variables. The results indicate that OFDI has a significant correlation (regardless of the direction of the relationship) with the explanatory factors, except with per capita GDP (GDPP), fixed capital formation (GFCF), and inflation. Similarly, the correlation matrix in Table 2 indicates a significant OFDI correlation with politics (POL) and government regulations (REG) (Table 2, Column 1). The variance inflation factor (VIF) estimation indicates a tolerable multicollinearity level between the covariates (see VIF in Appendix 2). Furthermore, the study estimated the ID separately to control the effects of autocorrelation and multicollinearity between the ID variables.

A prior baseline investigation (Table 3, Column 1) was conducted using fixed-effect models with explanatory and control variables without including the ID variables. The

Variable	Obs	Mean	Std. Dev.	Min	Max
POP	588	16.960	17.207	13.039	19.041
RR	588	2.809	2.651	−0.798	4.151
GDPP	588	7.740	8.084	5.267	9.920
GDP	588	24.459	25.142	20.327	26.863
INF	588	2.120	2.449	*3.391*	4.643
TR	588	4.295	−3.565	2.950	5.741
GFCF	588	22.731	10.338	2.000	114.725
COR	588	−0.694	0.599	−1.81	1.22
RUL	588	−0.736	0.591	−1.85	0.73
REG	588	−0.721	0.594	−2.27	0.8
GOV	588	−0.766	0.559	−1.89	0.73
POL	588	−0.629	0.873	−2.7	1.2
VOICE	588	−0.685	0.732	−2.23	0.99
chi_COR	588	−0.451	0.122	−0.61	−0.25
chi_RUL	588	−0.462	0.100	−0.64	−0.26
chi_REG	588	−0.239	0.056	−0.33	−0.15
chi_GOV	588	−0.109	0.157	−0.12	0.41
chi_POL	588	−0.524	0.062	−0.66	−0.39
chi_VOICE	588	−1.626	0.085	−1.75	−0.46

Table 1.
Descriptive statistics

	1 Y	2 POP	3 RR	4 GDPP	5 GDP	6 INF	7 TR	8 GFCF	9 GOV	10 POL	11 VOIC	12 REGU	13 RUL	14 COR
1	1													
2	0.456***	1												
3	−0.163*	−0.237***	1											
4	0.088	−0.262***	−0.0411	1										
5	0.465***	0.666***	−0.238***	0.545***	1									
6	−0.082	−0.0339	0.269***	0.116	0.062	1								
7	−0.347***	−0.655***	0.505***	0.135*	−0.471***	0.079	1							
8	0.056	−0.518***	0.042	0.159*	−0.325***	−0.177**	0.253***	1						
9	0.128*	0.139*	−0.564***	0.142*	0.226***	−0.215***	−0.238***	0.097	1					
10	−0.105	−0.325***	−0.080	0.221***	−0.127*	−0.080	0.281***	0.252***	0.464***	1				
11	0.212***	0.151*	−0.482***	−0.203**	−0.036	−0.262***	−0.067	0.008	0.629***	0.520**	1			
12	0.099	0.025	−0.517***	0.107	0.099	−0.179**	−0.181**	0.0842	0.859***	0.436***	0.592***	1		
13	0.288***	−0.029	−0.495***	0.193**	0.119	−0.186**	−0.154*	0.221***	0.811***	0.548***	0.633***	0.745***	1	
14	0.159*	−0.019	−0.522***	0.039	0.008	−0.208**	−0.037	0.128*	0.793***	0.455***	0.677***	0.697***	0.843***	1

Note(s): Where ***, ** and * are significant p-value at 1, 5 and 10 percent, respectively

Table 2.
Correlation matrix

Table 3.
SFA estimation

Column	1 Fe	2 SFA_All	3 COR	4 RUL	5 REG	6 GOV	7 POLS	8 VOICE
POP	−4.297** (−2.28)	−4.290*** (−3.65)	−1.870** (−2.52)	−2.101** (−2.05)	−4.124 (.)	−4.208 (.)	−0.068 (−0.03)	−1.728*** (−11.67)
RR	0.211** (2.17)	0.213** (2.25)	0.188*** (3.92)	0.274*** (4.41)	0.251*** (3.33)	0.225*** (3.80)	0.294*** (3.77)	0.205** (2.14)
GDPP	−4.264** (−2.28)	−4.440*** (−3.84)	−1.829** (−2.47)	−2.132** (−2.09)	−4.134 (.)	−4.263*** (−61.86)	−0.354 (−0.14)	−1.799 (.)
GDP	5.113*** (2.73)	4.996*** (4.37)	2.641*** (3.56)	2.876*** (2.83)	4.933*** (108.06)	4.978 (.)	0.966 (0.38)	2.698*** (43.89)
TR	−0.001 (−0.43)	−0.002 (−0.51)	−0.002* (−1.72)	−0.001 (−1.38)	−0.001 (−0.84)	−0.001 (−0.70)	0.002 (0.6)	0 (−0.33)
GFCF	0.005 (0.83)	0.219** (2.01)	0.011*** (2.86)	0.011** (2.31)	0.006 (1.35)	0.006 (1.28)	0.007 (0.98)	0.014** (2.51)
INF	0.042 (0.64)	−0.036 (−0.54)	−0.028 (−0.84)	−0.026 (−0.76)	−0.019 (−0.46)	−0.019 (−0.55)	−0.336* (−1.70)	−0.018 (−0.46)
YEAR	0.294*** (27.72)	0.260*** (29.04)	0.234*** (31.65)	0.255*** (31.02)	0.282*** (96.54)	0.266*** (64.27)	0.273** (0.735)	0.253*** (28.73)
_cons		−530.417*** (−27.68)	−479.767*** (−32.47)	−521.279*** (−31.98)	−576.541*** (−98.78)	−542.577*** (−65.29)	−7.845*** (−6.45)	−522.268*** (−31.18)
Mu								
DI_COR		5.214** (2.31)	23.035 (1.11)					
DI_RUL		−2.804 (−1.14)		0.882*** (4.69)				
DI_REG		6.891*** (3.18)			3.319** (2.15)			
DI_GOV		9.96 (0.04)				2.477** (2.56)		
DI_POL		−7.013** (−2.23)					−0.728** (−2.21)	
DI_VOICE		−4.244 (−1.17)						−9.664 (−0.89)
_cons		−27.384** (−2.08)	−14.069*** (−1.91)	−41.349** (−3.21)	−24.350** (−2.09)	−17.056** (−2.41)	1.018 (0.81)	−29.989 (−0.83)
Usigma								
_cons		3.405*** (8.58)	4.375*** (4.78)	5.736*** (6.48)	2.461*** (5.39)	2.348*** (6.15)	2.269*** (7.95)	3.719*** (3.34)
Vsigma								
_cons		−1.962*** (−4.35)	−3.053*** (−9.29)	−3.010*** (−8.00)	−2.452*** (−9.60)	−2.159*** (−7.54)	−0.767*** (−2.70)	−2.861*** (−8.31)
Theta								
_cons		1.030*** (6.28)	−1.213*** (−26.82)	−1.081*** (−18.04)	1.199*** (16.27)	1.140*** (19.38)	1.152*** (13.12)	−1.094*** (−20.16)
γ		0.750	0.672	0.784	0.502	0.542	0.897	0.628
N		575	588	587	588	588	587	577
F								
r2_a	0.7592							
N_g	42	42	42	42	42	42	42	42

Note(s): *$p < 0.01$; **$p < 0.05$; ***$p < 0.001$

baseline results contain the total population (POP), GDP, resource rents (RR), total trade (TR), fixed capital formation (GFCF), year and per capita GDP (GDPP) of the host country. The estimation was established using the SFA model only to observe the fixed-effect results without considering the ID factors and compared, when necessary, with the results in Columns 2–8. Table 3, Columns 2 to 8, display the SFA results containing the ID variables (Column 2 lists all the ID factors to perceive institutional distance's effects). However, to control multicollinearity and autocorrelation effects, the study deployed the ID variables separately (Table 3, Columns 3–8). To mitigate a potential issue of reverse causality, we also lagged the variables by one year, except for the year variable. Accordingly, the baseline estimation in Table 3, Column 1, indicates a positive and significant effect for RR, GDP, and year on OFDI at a minimum statistical significance level of 5%. The empirical results suggest that China's investment in Africa responds positively to market opportunities measured in GDP and to resource available economies measured in RR. The result aligns with the findings of Cheung *et al.* (2012). However, the POP of the host country and GDP per capita income depict a significant negative effect on OFDI at a 5% statistical significance level. Using the fixed-effect estimation model, the other control variables, such as GFCF, INF and TR, were deemed insignificant to determine any effect on Chinese OFDI in African countries. The estimation in Column 2 (with the inclusion of the efficiency estimates Z variable) also supports the estimation result of the in Column 1 except for GFCF.

The SFA estimations in Table 3 (Columns 2–8) consider the parameters in the stochastic frontiers for Chinese OFDI in African countries using ID variable separately. The results of explaining variables more or less depict similar effects on Chinese OFDI in the African countries. Following Battese and Corra's post-estimation test (1977), this evidence corroborated the overall appropriateness of the model (identified by statistically insignificant values of γ (see Table 3).

The estimation indicates a higher RR and better economic performance represented by the GDP of African countries contributing positively to the Chinese OFDI in Africa. This result supports the findings of various prominent studies (Alden, 2017; Asiedu, 2006; Kapuwa *et al.*, 2012; Kolstad and Wiig, 2011), which indicated higher investments in countries with higher RR and GDP. The estimation infers negative and significant effects of African countries' GDPP (Columns 1, 2, 3, 4 and 6) on Chinese OFDI, implying that Chinese FDI is deterred by an increase in per capita income in African countries. Although the established and contemporary intuition of OFDI indicates an increasing OFDI with a GDPP increase, the result supports Cushman's findings (1987), where a rise in per capita income and wages discourages FDI in a new region. This particular result calls for further empirical assessments on the relationship between Chinese investments and African countries, emphasising the role and effects of GDPP growth.

> Year, which is included as a covariate to describe the trend of the explained factor over time, presents a positive and significant effect, indicating a drastic FDI increase in Africa. Unlike the time of Maoist China, multifaceted economic ties could be taken as strong driving force for the flow of investment from China to African countries (Lu *et al.*, 2017; Mourao, 2018).

Table 3 further contains a separate estimation of Z variables, which explains the stochastic efficiency levels of Chinese OFDI in Africa (See Columns 3–8 and the ID factors). Mourao's (2018) study specifies an efficiency case to imply a higher level of Chinese OFDI given the countries' factors. For instance, suppose RR is a significant factor of OFDI, then country X will be more efficient than country Y in attracting more OFDI if 100 monetary units of OFDI are allocated in country X (where 70 people live with plenty of RR) and 300 monetary units of OFDI are allocated in country Y (where 300 people live with comparable RR).

The analysis and discussion mainly comprise information based on Columns 3–8 (to control multicollinearity, the estimation in Columns 3–8 is made by considering each ID

separately). Accordingly, the result indicates that rule of law, regulatory quality, government effectiveness and political stability distance on Chinese OFDI had significant effects in Africa. These positive and significant effects imply an increase in institutional distance (ID of rule of law, regulatory quality and government effectiveness) between the countries (home and host countries) exacerbate the inefficiency of Chinese OFDI in Africa. The negative results, which imply a higher value of the variable, correlate with smaller inefficacy parameters. Therefore, the efficiency of Chinese OFDI decreases with an increasing ID between the host and home countries. Unlike developed countries that pay additional costs to ensure investment efficiency in developing countries, the Chinese MNE does not necessarily suffer to adapt to the institutional environment of less developed host country (Cezar and Escobar, 2015). Similarly of institutions between host and home countries ease the burden for Chinese MNE to easily adapt to large ID without incurring unnecessary adjustment costs (Che *et al.*, 2017). Thus, the *Z* factor results confirm the conception of China's investment resilience in countries with weak institutions that could create larger institutional distance with its institutions (Cezar and Escobar, 2015; Kolstad and Wiig, 2011; Mourao, 2018).

Contrariwise, MNEs from countries with a strong institutional quality are less likely to invest in countries with a weaker institutional quality. Such difference may lower MNEs' profitability and burden developed countries with additional adjustment costs in the hosting countries (Cezar and Escobar, 2015; Che *et al.*, 2017). Thus, our result irrefutably illustrates that the institutional level plays a decisive role in Chinese MNEs investing in countries with comparable institutional levels, such as Africa.

Hereafter, the study discusses on the effects of ID on the inefficiency of Chinese OFDI in Africa. According to the results, Corruption and accountability and voice do not have a significant impact on the Chinese OFDI in Africa, however, the study observes less rule of law, regulatory quality and government effectiveness quality value significantly promoting efficient Chinese FDI in African countries. The result follows Kolstad and Wiig (2011), who have identified high levels Chinese FDI flow in countries with some particular weak political institutions.

Unlike the other significant ID factors, the political stability distance was exceptionally negative and significant at 5%, implying that the political stability distance has a positive and considerable efficiency effect on Chinese investment in Africa. The coefficient's value exhibits a negative and significant result, implying stable African country with stable political institutions can promote higher FDI flow to Africa. The results substantiate the findings of (Mourao, 2018). According to Lu *et al.* (2017) wherever there is high political risk and hazards Chinese investors tend to use joint venture to invest in African country.

By analysing Table 3, we also extracted the average efficiency/inefficiency using Jondrow, Lovell, Materov, and Schmidt (JLMS) and Battese and Coelli (BC) scores for the significant factors for the countries for 2003–2016. For a greater comparison, only the average efficiency scores of the factors and the countries in Tables 4 and 5 are listed, respectively (detailed results are available upon request).

The low mean average efficiency scores of 0.205, 0.558, 0.241, 0.564 and 0.552 demonstrate the untapped and underutilised potential of Chinese OFDI in Africa. This value implies that although the Chinese are investing in Africa with the existing institutions and institutional distance, their investment potential is not yet fully realised (Fan *et al.*, 2016). Kolstad and Wiig (2011) also explained how Africa is rich and lucrative for Chinese investors.

Table 4 lists the average efficiency score of the countries in which China invests. The average mean indicates a lower overall efficiency (0.205). In other words, given the existing ID, one can claim that although Chinese MNEs have identified the lucrativeness of investing in Africa, Chinese FDIs need to take full advantage of the substantial margin of development in African economies.

Variable	Obs	Mean	Std. Dev.	Min	Max
COR_jlms	588	0.205	0.215	0.000	0.823
COR_bc	588	0.223	0.227	0.000	0.835
GOV_jlms	588	0.558	0.238	0.003	0.934
GOV_bc	588	0.617	0.314	0.000	0.976
POL_jlms	587	0.241	0.215	0.000	0.784
POL_bc	587	0.273	0.229	0.000	0.801
REG_jlms	588	0.564	0.231	0.003	0.929
REG_bc	588	0.576	0.309	0.000	0.971
VOICE_jlms	577	0.562	0.244	0.003	0.944
VOICE_bc	577	0.605	0.325	0.000	0.982
RUL_jlms	587	0.552	0.250	0.003	0.933
RUL_bc	587	0.551	0.324	0.000	0.979

Table 4. Average efficiency level

To offer more insight, the country-wise average efficiency is depicted in Table 5. The highest mean average efficiency values belong to Liberia with the highest efficiency value of the rule of law and government effectiveness distance of 0.683 and 0.685 consecutively, in political distance. Kenya (0.681) and Cameroon (0.681) have the highest efficiency value of regulatory distance. These values may indicate Chinese FDI potential in Africa and infer inevitable investment flows in the future, regardless of China's current investment in countries with comparable institutions and tolerance for institutional distance.

Concerning the minimum mean values of ID, Burkina Faso (0.249), Malawi (0.339), and Niger (0.372) may infer the effects concerning rule of law on Chinese FDI (Kapuwa *et al.*, 2012; Melber, 2003). According to Kapuwa *et al.* (2012) and the implication of the result, out of 53 nations, Burkina Faso was amongst the three countries that had not received sufficient Chinese FDI, while Malawi was struggling with a substantial crisis related with institutions, particularly due to rule of law (Mourao, 2018). The same study indicates that Malawi's were accused by serious human right issues and unclear political reforms of threating the country's attractiveness to foreign investors. Similarly, Zuber *et al.* (2017) also identified increasing decay in rule of law that led to instability and violence in Burkina Faso and Niger in the study's timeframe. The Republic of Liberia, however, had the highest mean value (0.685). Given the national conditions in Liberia, this efficiency score implies that Chinese FDI has reached a high value (Ancharaz, 2009; Svirydzenka and Petri, 2017) and confirms the findings of Zuber *et al.* (2017) that showed substantial improvements from 2003 to 2013 in political stability and absence of violence/terrorism, voice and accountability and regulatory quality for Liberia. Moreover, the political stability (0.681) and the regulatory quality of Kenya (0.676) have contributed to the success of OFDI efficiency, as is suggested by Yao and McDonald's analysis (2003). The result might also be due to Kenya's higher performance in public sector management and institutions (Zuber *et al.*, 2017).

Conclusion

This study contributes to the empirical literature by highlighting the importance of institutional differences between home and host countries. The study did not directly investigate the effect of countries' institutional quality levels on the flow of investment, but focused on the institutional quality distance between home and host countries. Since there are insufficient studies regarding the impacts of the institutional distance between China and hosting African countries, the recent economic and political ties between Africa and China provide an interesting assessment. By utilising a panel of African countries, this study examined the distinct effect of each institutional distance on Chinese OFDI in African

Country	rul_jlms	rul_bc	gov_jlms	gov_bc	pol_jlms	pol_bc	reg_jlms	reg_bc
Angola	0.482	0.463	0.486	0.455	0.501	0.358	0.507	0.360
Burundi	0.550	0.084	0.545	0.099	0.549	0.095	0.539	0.097
Benin	0.517	0.644	0.507	0.645	0.505	0.620	0.496	0.614
Burkina Faso	0.249	0.031	0.317	0.053	0.297	0.051	0.325	0.053
Botswana	0.579	0.723	0.580	0.792	0.623	0.788	0.596	0.745
C. African Republic	0.545	0.576	0.568	0.679	0.554	0.691	0.566	0.670
Cote d'Ivoire	0.475	0.360	0.513	0.318	0.489	0.264	0.493	0.290
Cameroon	0.682	0.197	0.683	0.303	0.680	0.250	0.681	0.260
Congo, Dem. Rep.	0.573	0.805	0.578	0.840	0.566	0.807	0.592	0.821
Congo, Rep.	0.619	0.779	0.630	0.817	0.606	0.800	0.616	0.771
Cabo Verde	0.521	0.262	0.516	0.371	0.547	0.396	0.517	0.363
Algeria	0.635	0.520	0.600	0.670	0.639	0.545	0.622	0.548
Egypt, Arab Rep.	0.626	0.213	0.625	0.294	0.638	0.198	0.615	0.227
Eritrea	0.426	0.596	0.459	0.644	0.438	0.646	0.536	0.651
Ethiopia	0.606	0.650	0.597	0.721	0.620	0.656	0.610	0.675
Gabon	0.602	0.501	0.593	0.687	0.582	0.664	0.581	0.590
Ghana	0.510	0.610	0.518	0.608	0.544	0.545	0.543	0.550
Guinea	0.686	0.884	0.665	0.905	0.659	0.903	0.643	0.875
Guinea-Bissau	0.409	0.869	0.412	0.918	0.384	0.926	0.408	0.900
Equatorial Guinea	0.606	0.318	0.659	0.609	0.667	0.592	0.649	0.492
Kenya	0.676	0.787	0.668	0.813	0.681	0.734	0.676	0.759
Liberia	0.683	0.957	0.685	0.940	0.679	0.944	0.658	0.928
Libya	0.504	0.104	0.519	0.157	0.479	0.127	0.524	0.120
Madagascar	0.637	0.922	0.635	0.907	0.609	0.899	0.601	0.880
Mali	0.621	0.641	0.627	0.772	0.662	0.739	0.640	0.730
Mozambique	0.549	0.770	0.560	0.766	0.608	0.736	0.603	0.746
Mauritania	0.587	0.408	0.603	0.561	0.626	0.560	0.603	0.510
Malawi	0.339	0.416	0.396	0.370	0.404	0.344	0.420	0.345
Namibia	0.469	0.882	0.487	0.900	0.492	0.887	0.489	0.875
Niger	0.345	0.550	0.372	0.601	0.412	0.585	0.419	0.557
Nigeria	0.596	0.504	0.587	0.553	0.590	0.373	0.599	0.432
Rwanda	0.653	0.421	0.647	0.565	0.665	0.538	0.641	0.543
Sudan	0.626	0.771	0.588	0.788	0.590	0.769	0.598	0.735
Senegal	0.540	0.284	0.560	0.334	0.608	0.286	0.580	0.301
Sierra Leone	0.597	0.824	0.603	0.882	0.589	0.878	0.575	0.856
Chad	0.541	0.517	0.553	0.509	0.557	0.455	0.568	0.449
Tunisia	0.535	0.028	0.489	0.035	0.488	0.029	0.470	0.031
Tanzania	0.670	0.816	0.652	0.863	0.659	0.829	0.624	0.824
Uganda	0.465	0.350	0.483	0.474	0.479	0.410	0.505	0.425
South Africa	0.494	0.705	0.488	0.789	0.511	0.728	0.487	0.724
Zambia	0.632	0.968	0.651	0.958	0.640	0.957	0.619	0.943
Zimbabwe	0.557	0.956	0.542	0.932	0.576	0.923	0.640	0.918

Table 5.
Average efficiency and inefficiency values of 42 African countries

countries for 2003–2016. To discuss and determine the factors of Chinese OFDI in Africa, we used the true fixed-effect SFA model, which supersedes others due to its ability to provide information on the average efficiency concerning the distance of corruption, the rule of law, political instability, voice and accountability, government effectiveness and regulatory quality of the 42 African countries on China.

The study found that resource rents (RR) and local market size (GDP) positively and significantly determine Chinese OFDI movements. The results registered higher investment in countries with larger resources and a huge market size, thereby corroborating the empirical findings of various researchers (Asiedu, 2006; Cheung *et al.*, 2012; Kapuwa *et al.*, 2012; Kolstad and Wiig, 2011). Inversely, the effects of POP and GDPP depicted a negative

and significant effect on the flow of Chinese OFDI; thus, further investigations are required to determine its conclusive relationship and impacts. The remaining controlled variables' effects were insignificant to determine any kinds of effects. Most importantly, using the advantage of the SFA model, the study determined the efficiency effect of the ID of the host and home country.

The result indicates insignificant effects of voice and transparency and control of corruption distance on Chinese OFDI in Africa. However, the study depicts significant effects of government effectiveness, regulatory quality, and the rule of law on Chinese OFDI in Africa. The positive and significant values of rule of law, regulatory quality and government effectiveness imply that an increase in ID between the countries does not impede Chinese OFDI in Africa, thereby supporting the notion of China's investment flexibility and potential adaptability in countries with comparably weak institutions.

Unlike the other significant institutional distance factors, higher political stability promotes efficiency for Chinese OFDI in African countries, inferring that Chinese MNEs are intolerant to directly investing in countries with political unstable countries. Moreover, the overall average values of the efficiency score are shallow, indicating a low Chinese direct investment efficiency in Africa.

This study can be considered novel, particularly in identifying the efficiency scores of the African countries by overpassing conventional methods of identifying the significance levels of the determinants. The results also bring about policy implications. Firstly, African countries with a comparable institutional quality with China might have a better opportunity of attracting direct investment from China. Similarly, these countries' policymakers should pay substantial attention to MNEs deriving from countries with comparable institutional quality and identify necessary preconditions (e.g. location, motivation, perception and prior operation track records, including corporate responsibilities) to increase the investment efficiency of their economy. Secondly, the African countries have to maintain political stability to enhance direct investment towards the content. Lastly, efficiency in attracting investment is a required feature of any MNE. Thus, MNEs must manage direct investments according to their technical efficiency goals and the political, social and economic realities of the home country's institutions.

Finally, although the study's findings have implications for China–Africa investment relations, the relative institutional distance may not provide an accurate and overall picture of institutional quality since individual African countries may exhibit varying levels of institutional quality. Future studies can refine this research and accommodate the differences in countries' institutional quality by further subdividing the host African countries into Sub-Sahara Africa, North Africa, and resource-dependent categories. Also, by identifying the familiarity between the host and home countries, it facilitates an opportunity to assess the effect of familiarity bias on investment decisions and efficiency. Moreover, as Amighini *et al.* (2013) and Cui and Jiang (2010) stated, government participation affects Chinese MNEs' direct investment choices and efficiency. Thus, further studies may be extended by classifying countries according to the level of government intervention and sovereignty in MNE investment-making, thereby prompting better empirical findings for policy advisory consumption and academia.

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Appendix 1

Variables	Description	Remarks
OFDI (DV)	Chinese outward direct investment (Stock)	China Statistical Bulletin
POP (CV)	The total population of the countries	WDI*
RR (IV)	Total natural resources rents (% of GDP)	WDI
GDPP (IV)	GDP per capita (current US$)	WDI
GDP (IV)	GDP (current US$)	WDI
INF (CV)	Inflation, GDP deflator (annual %)	WDI
TR (CV)	Trade (% of GDP)	WDI
GFCF (CV)	Gross fixed capital formation (% of GDP)	WDI
COR	Host country corruption level	WDI
RUL	Host country rule of law level	WDI
REG	Host country regulatory quality level	WDI
GOV	Host country government effectiveness level	WDI
POL	Host country political stability level	WDI
VOICE	Host country voice and transparency corruption level	WDI
chi_COR	China corruption level	WGI**
chi_RUL	China rule of law level	WGI
chi_REG	China regulatory quality level	WGI
chi_GOV	China government effectiveness level	WGI
chi_POL	China political stability level	WGI
chi_VOICE	China vice and transparency level	WGI
Distance of corruption	Corruption difference between Africa and China	WGI (calculated)
Distance rule of law	Rule of law difference between Africa and China	WGI (calculated)
Distance regulatory quality	Regulatory quality difference between Africa and China	WGI (calculated)
Distance government effectiveness	Government effectiveness difference between Africa and China	WGI (calculated)
Distance political instability	Political instability difference between Africa and China	WGI (calculated)
Distance voice and accountability	Voice and accountability difference between Africa and China	WGI (calculated)

Note(s): DV = Dependent variable; IV = Independent variable; CV = Control variable
*World Development Indicator; ** World Governance Indicator

Table A1. Variables and definitions

Appendix 2

Variables	VIF value
POP (CV)	4.32
RR (IV)	3.02
GDPP (IV)	2.91
GDP (IV)	5.41
INF (CV)	3.76
TR (CV)	1.33
GFCF (CV)	5.27
COR	4.32
RUL	5.22
REG	3.77
GOV	4.22
POL	4.94
VOICE	4.30

Table A2. Variance inflation factor (VIF)