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Impact of China's outward direct investment on economic efficiency

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ABSTRACT

This paper examines the impact of China's Outward Direct Investment (ODI) on the world economy in terms of economic efficiency and aims to provide insight for the host economies in strategizing their investment policies. This study employs Stochastic Frontier Approach (SFA) to estimate the impact of China's ODI on the world for both developed and developing economies. The research encompassed a total of 156 nations for the period spanning from 2009 to 2017. The findings indicate that there is a 13.3% disparity in efficiency between industrialized and developing countries. The results further reveal that the China's ODI to developing countries contributes to the reduction of inefficiency in both the Cobb-Douglass and Trans log models. Results for developed countries are mixed, with a significant contribution to inefficiency reduction in the Cobb-Douglass model only. Findings in this paper rebuke the general acceptance that ODI is good in everything for the host countries. Instead, ODI will be more beneficial to the host countries to reduce inefficiency if they are at a lower level of development than the home countries. The findings recommend China's ODI to developing countries, while developed countries may still reap positive spillovers on efficiency with careful selection of the type of ODI from China to match their national economic development agenda.

Contribution/ Originality: This is the first empirical paper to examine the impact of China's ODI on economic efficiency in developed and developing countries. This study contributes to the strategic economic planning of the host economies in foreign direct investment policy to gain full advantage from the influx of China's investment in the world.

1. INTRODUCTION

Foreign direct investment (FDI) is widely acknowledged as the catalyst for the economic growth of the recipient countries. FDI from developed economies is believed to produce positive spillover effects given superiority in technology and knowledge transfer to less advanced countries (Fu, Buckley, & Fu, 2020; Grossman & Helpman, 1991; Kong, Guo, Wang, Sui, & Zhou, 2020). Additionally, it is considered an important source of capital for domestic firms' businesses and technology expansion in developing countries, given the limited funds in the domestic economies for investment in technology and infrastructure. Hence, FDI contributes to employment creation and economic development because it brings in new technology, better management know-how, and assists in human capital

development, which enhances productivity in developing countries (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Blomström & Kokko, 1998; Suliman, Elian, & Ali, 2018). In developed economies, outward direct investment (ODI) serves as part of the firms' strategic plan for internationalization. Therefore, direct investment creates mutual benefits as well as the interdependence of the recipients and their countries of origin. Over the past decades, China's investment has increased. China's Global Ranking of ODI rose from 23 to 2nd place in 2021 as compared to 2002, notwithstanding the drop in China's ODI because of the US-China trade war (Ministry of Commerce People Republic of China (CMC), 2021). This is largely due to the strategies used by the Chinese government to penetrate foreign markets using its state-owned enterprises.

The "Going out Policy" in October 2000 and the accession of China to the World Trade Organization (WTO) since 2001 contributed to the increase in China's FDI to the world. The efforts to extend China's ODI continued with the Belt and Road Initiative (BRI) by President Xi in 2013 (Chan & Har, 2021). This marked the starting point of a major influx of ODI from China into developing countries with the aim of establishing connectivity between Asia and Europe. The COVID-19 pandemic economically impacted many economies around the globe. However, based on the 2021 "Statistical Bulletin of China's Outward Foreign Direct Investment", China's net ODI continued to grow at a rate of 16.3% as compared to 2021. As of the end of 2021, there are 46 thousand FDI enterprises in 190 countries in the world (Ministry of Commerce People Republic of China (CMC), 2021). This marks the increasing role of China's ODI in the global economies that deserve our attention. Furthermore, COVID-19 provides a new opportunity for China to expand its investment in developing countries through the Regional Comprehensive Economic Partnership (RCEP) in November 2020. RCEP aims to revitalize the whole economic ecosystem and supply chain through the transformation of digitalization. Nevertheless, the impact of China's ODI on developing economies is still debatable (Deng, 2004; Kong et al., 2020; Peyrouse, 2016). In fact, the studies on FDI are relatively scant, and the impact of China's ODI is questionable on its motivations, such as resource seeking, market shares, and political interest (Deng, 2004; Meunier, 2012; Peyrouse, 2016).

The trend of China's ODI is changing from resource-seeking to focusing on supplying power and utilities, which accounted for 25.2%, and the manufacturing sector, which accounted for 19.8% (Ministry of Commerce People Republic of China (CMC), 2021). The shift in the trend for China's ODI recently may have different impacts on the host countries' economic development. Consequently, further study to evaluate the impact of China's ODI on the host economies is crucial to providing a contemporary result. Besides that, it also serves as an insight for the host economies to strategize their foreign direct investment policy and future collaboration with China. Therefore, this paper aims to examine the impact of China's ODI on the economic efficiency of the host countries. This is vital because the road to a successful partnership in direct investment lays on the fundamental concept of efficiency rather than solely focusing on economic growth. Quantifying China's ODI effects in terms of efficiency is important to sustainability because efficiency implies the ability of the host economy to allocate and effectively employ its resources in generating economic growth. In this case, the positive effects of ODI on any country's economic efficiency are essential for long-term economic sustainability. This issue gains increasing attention after the COVID-19 crisis, geopolitical tensions, and climate change. There is no parallel literature like this paper for quantifying the impact of China's ODI on economic efficiency in both developed and developing countries. We hope this paper could help facilitate better decision-making by the recipient economies on the sustainability of China's ODI. Finally, the paper also aims to shed some light on how policymakers can implement better policies that could create win-win results between China and the host economies, which seems to be undeniably vital, especially through the Belt and Road Initiative (BRI). The following is the order in which our paper is structured: A review of China's ODI's literature is given in Section 2. The study's methodology is presented in Section 3. Results are covered in Section 4, and Section 5 provides a conclusion.

2. LITERATURE REVIEW

Earlier studies on China's ODI show that China's ODI differs from that of developed countries because their investment mostly focuses on countries with weak institutional quality (Buckley et al., 2009; Ramasamy, Yeung, & Laforet, 2012), motivated by resource seeking (Deng, 2004), and political interest (Buckley et al., 2009). Nevertheless, the net benefits generated from the efficiency transfer by Chinese firms to the recipient country remain inconclusive. Buckley et al. (2009) examined the FDI determinants to establish the theoretical explanations of the Chinese investment. Their results suggest that Chinese ODI are motivated by resource-seeking because they are attracted to countries that are endowed with huge natural resources. In addition, the results highlight that China's ODI is motivated by political interest. This is supported by the analysis by Deng (2004), where Chinese companies have little incentive for efficiency-seeking given their abundant productions as a result of low-cost labour and inexpensive land. This leads to a situation where Chinese multinational firms also tend to disregard the efficient allocation of resources. In addition, Jin and Huang (2023) found China's ODI increased its natural resource footprint in Belt and Road Initiative (BRI) host countries. Kolstad and Wiig (2012) believed ODI from China was positively related to the availability of natural resources as well as worse-than-average institutional quality. These may contribute to the inefficiency of the Chinese firm's operation in the host countries. The resource-seeking FDI from China may not necessarily benefit the host country's growth in the long run, but merely secure domestic production in China itself (Zhang & Daly, 2011). Such motives may jeopardize the host country's security since Central Asian countries would then rely on China for basic goods and necessities (Peyrouse, 2016). In contrast, China's ODI to developed economies contributed positively to China's green economic efficiency (Wang & Wang, 2023) and green total factor productivity (Guo & Wang, 2023).

Meanwhile, China investment in Southeast Asia, along with the presence of political influence, would further influence the countries' wealth. The contribution from China's ODI in Malaysia is also concerned by Chan and Har (2021) in terms of the crowding-out effect, resource-seeking, job-creation, and alignment with the host country's development policy. Therefore, the impact of China's ODI on the host country's economic growth may not materialized as opposed to the ODI from developed economies. In a similar vein, Ramasamy et al. (2012) also suggest that China's ODI mostly comes from state-owned enterprises (SOEs) and tends to invest in the natural resources of rich and risky political environment. The SOEs are relatively inferior in terms of experience and advancement in technology when they invest abroad, as compared to the developed nations of European nations, the United States, and Japan (Wu & Chen, 2001). Besides that, the FDI in China is found to help the government boost governmental diplomacy ties with the host countries rather than gaining market shares through efficiency-seeking (Qi, 1999; Qiao, 1996). It is related to the fact that China's ODI is part of the government's development plan; hence, the investment strategies of the Chinese multinational companies comply closely with the government's priorities (Deng, 2004). Chen, Dollar, and Tang (2018) further pointed out that Chinese firms have a poor track record in terms of corporate governance as compared with Western investors in African countries. This may defeat the initial motivation to attract ODI (Outward Direct Investment) to the developing economies that is expected to benefit the host country via management know-how and enhance the efficiency in the long run. Therefore, the advantages of China's ODI to the world are rather debatable. For example, Cai, Zhao, Wu, Ge, and Long (2023) found evidence that China's ODI can promote green technology spillovers with an asymmetric impact based on different income levels, degrees of openness, and regulations in the host country. However, the role of investments from China throughout recent years has gradually shifted from resource-seeking to investment in technology-intensive industries. This is proven by the list of Forbes Global 2000 companies, where the list has grown from 43 to 309 companies (China and Hong Kong) dominated by banking and financial institutions and followed by technology and energy companies since 2003.

A review by Khan and Arora (2017) on China's ODI in the African region also supports the contribution of China's investment in terms of the development of better infrastructure, employment creation, and improvement in local economic growth, despite its resource-seeking objective. In fact, the Chinese government has shifted their focus

to more high-quality and technology-driven ODI policies to enhance quality and efficiency and improve the productivity of both host and home economies (Cheng, Wang, Peng, & Kong, 2020). The findings from Seyoum, Wu, and Yang (2015) suggest positive technology spillovers by Chinese multinational companies in Ethiopia are mainly due to the smaller technology gap effect. As pointed out by Yao, Zhang, Wang, and Luo (2017), Chinese technology is better adapted in developing countries due to the smaller technological gap. China's technology is convenient and costless to adapt for developing economies that need economic development. This was first welcomed by the Association of Southeast Asian Nations (ASEAN) developing countries (Cambodia, Malaysia, and so on, for example) because China's ODI reduces the dependency of the countries on the developed nations (like the United States, Germany, and Japan) in terms of financing and expertise like human capital. These are supported by Fu, Hou, and Liu (2018) and Fu et al. (2020), where a smaller technology gap between China's ODI and the developed economies resulted in higher efficiency gains due to the catching-up effect. However, this is in contradiction with the studies of FDI that believe more technologically backward countries will gain more from FDI from relatively technologically superior countries because of technology transfer (Findlay, 1978; Li & Liu, 2005; Xu, 2000).

On the other hand, the studies on the impact of ODI from China on developed economies are insignificant due to the reasons that China uses ODI in developed countries to attain openness to key strategic assets, resources, and leading-edge technologies (Liu, Buck, & Shu, 2005; Ramamurthi & Singh, 2009). The ODI enables Chinese firms to improve in terms of technology by tapping into the good governance and protection of intellectual property in these countries. Thus, investing in developed economies provides China with security in intellectual property protection and technology innovation (Fu et al., 2018). Reciprocally, host countries in developed economies in Europe benefited from huge amounts of cash flows that contributed to research and development (R&D) activities, as reported by the Mercator Institute for China Studies (MERICS) in 2015 (Zenglein, 2020). Thus, creating a win-win situation between both countries (Hanemann & Huotari, 2017). Nevertheless, the ODI from China is also questioned on the objectives of resource-seeking and political interest and concentrated in high-risk countries (Pan, 2018). The review of the literature found inconclusive evidence on the impact of China's ODI on the host economies. Besides that, the studies mainly focused on the spillover effects measured by economic growth. To add to the literature on FDI, the paper places emphasis on the impact of China's ODI on economic efficiency rather than economic growth. This is because economic efficiency enables us to look into the resource allocations of the host economies as a result of China's ODI for sustainable economic development.

3. METHODOLOGY

The study sample covers 156 countries for the period of 2009 to 2017. The sample is further separated into developed and developing countries because of different technological developments that could respond differently to China's ODI. Appendix 1a and 1b present the lists of developed and developing countries, respectively. As ODI is assumed to affect the countries' economic efficiency in the long-run rather than the short-run, the study thus restricts the samples to countries that must have at least three years of data. The impact of FDI from China on the host economies is estimated using stochastic frontier analysis (SFA) with a true fixed effect (TFE) model. The TFE model was proposed by Greene (2005) with the argument that the inefficiency effect and the time-invariant firm-specific effect are different and hence need to be accounted for separately. Previous estimations of panel data SFA by Battese and Coelli (1995) and Simar and Wilson (2007) treated unobserved heterogeneity as a measure of inefficiency and did not allow for individual effects, which may not be able to accommodate the individual country effects, especially in panel data estimation. This model was chosen because it enables separating the time-invariant heterogeneity from the time-varying inefficiency and simultaneously estimating the impact of China's ODI on the efficiency of the country.

When you use SFA, you can estimate both the level of efficiency and the correlates at the same time. This gives you a more accurate and unbiased estimate than a two-stage estimation method. In addition, SFA provides a more

precise and accurate estimation of the allocation of resources as compared to the non-parametric method because it estimates the real efficiency rather than the comparative efficiency. Aigner, Lovell, and Schmidt (1977) and Meeusen and Van Den Broeck (1977) were the first to propose SFA as a method for estimating the inefficiency of decision-making units (DMUs) using the frontier approach. SFA imposes the same technology across all countries in the sample, so dividing the sample into developed and developing countries is necessary to fulfil this assumption and minimise the deviation of technology across countries.

This paper employed SFA instead of a non-parametric approach because it allows us to recognize the influences of statistical noise and productive inefficiency, thus enabling formal statistical hypotheses testing (Hjalmarsson, Kumbhakar, & Heshmati, 1996). The paper used a trans log specification based on true fixed-effect estimation proposed by Greene (2005) based on Equation 1 to accommodate for the time-invariant variables given the dynamic of China's ODI over the years. SFA based on true fixed-effects models can separate the time-invariant heterogeneity from the time-varying inefficiency, especially when we are employing a dataset of more than five years (2009-2017) (Greene, 2005). Additionally, time-varying inefficiency is critical to evaluating the dynamic of China's ODI overtime.

$$lnGDP_{it} = \propto_0 + \propto_1 lnK_{it} + \propto_2 lnL_{it} + \frac{1}{2} \propto_{12} lnK_{it} lnL_{it} + \frac{1}{2} \propto_{11} lnK_{it} lnK_{it} + \frac{1}{2} \propto_{22} lnL_{it} lnL_{it} + v_{it} - u_{it} \quad (1)$$

$$u_{it} = \delta_0 + \delta_1 lnODI_{it} + \delta_2 TO_{it} + \delta_3 MA_{it} + \delta_4 GEX_{it} \delta + {}_5 \delta_5 lnCPI_{it} + \delta_6 Crisis + \varepsilon_{it} \quad (2)$$

The $lnGDP_{it}$ refers to the output-side gross domestic products (GDP) at chained PPPs is employed as the dependent variable for the SFA. i represents the individual variable at ith country ($i=1,2,\ldots,N$) and t represents the time at that year ($t=1,2,\ldots,N$). U_{it} is the inefficiency term that we seek to obtain. In SFA U_{it} and ε_{it} are taken as independent of each other and identically distributed across observations. The U_{it} is obtained with the specification of the distribution of F. Besides that, SFA allows for simultaneous estimation of the role of exogenous variables and the inefficiency score. This is crucial to overcome the inconsistency in the two-stage estimation approaches that violate the notion of independent and identically distributed inefficiency using a two-stage approach (Battese & Coelli, 1995; Kumbhakar & Lovell, 2000). In this case, the $U_{it} \sim N^+(u_{it}, \sigma_u^2)$ with $U_{it} = z_{it}' \varphi$ where the U_{it} is a realization from a truncated normal random variable, z_{it} is the vector of exogenous variables that may correlate with the inefficiency of the country, and φ is the parameter to be estimate.

Based on Halkos and Tzeremes (2009) and Halkos and Tzeremes (2009), the economic efficiency is grounded on production functions with two inputs, namely labour and capital. GDP is used throughout the world as the main indicator for the economic output and activity of a particular country. The inputs employed in the SFA estimation are the number of persons engaged (L) and capital stock (K). All the data are extracted from the Penn World Table, version 9.1. We convert the capital stock and the output-side GDP into real terms using the Consumer Price Index (2010=100) (CPI). The input and output vectors are then converted to natural logarithm. On the other hand, the correlates of the efficiency estimates (z_{it}) consist of trade openness (TO), which is defined as the sum of total imports and exports over GDP, monetary aggregate as a percentage of GDP (MA), government expenditures as a percentage of GDP (GEX), and CPI based on the endogenous growth model. China's ODI stock is obtained from the "2017 Statistical Bulletin of China's Outward Foreign Direct Investment", published by Ministry of Commerce of the People's Republic of China. The control variables employed are extracted from World Bank's World Development Indicators (WDI). This paper also controls for the economic crisis of the recipient countries using the dummy variable of banking crisis ($Crisis$) extracted from Global Financial Development Database by the International Monetary Fund (IMF).

4. RESULTS AND DISCUSSIONS

Based on the descriptive statistics in Table 1, China's ODI is approximately 39.86% higher in developing countries as compared to developed countries, with a reported average of USD2, 067.17millions. This might be due to relatively relaxed regulations that enable China to enter developing economies easier as compared to developed

economies. The initiation of the Belt and Road Initiative (BRI) in 2013 further contributed to the influx of China's ODI into developing economies (Chan & Har, 2021). In addition, in 2015, the National Development and Reform Commission, the Ministry of Foreign Affairs, and the Ministry of Commerce jointly issued the "Vision and Actions on Jointly Building the Belt and Road", which accelerates the Chinese ODI in developing economies (Chen, Liu, & Liu, 2020). Consistently, real GDP and capital stock in developed countries are higher compared to the given higher earning power in the developed countries. Besides, higher capital accumulation with advanced technology also contributed to higher capital stock in developed countries. As expected, all control variables in our sample for developed countries are relatively better compared to those in developing countries. To examine the validity of all the variables for estimation purposes, this paper estimated the correlation matrix as presented in Table 2. There is no serious multi-collinearity problem among the correlates employed in our model.

Table 1. Descriptive statistics.

Variables	Mean	Standard deviation	Minimum	Maximum
Developed countries				
Output-side real GDP (mil USD)	1,142,769.52	2,645,990.21	9,299.37	15,757,007.28
Capital Stock (mil. USD)	4,970,314.40	9,542,500.43	32,653.88	54,197,221.64
Number of persons engaged	13,561,249.68	26,592,583.91	160,740.05	154,436,447.14
China's ODI (Stock) (mil. USD)	2,958.98	7,686.83	0.54	67,381.00
Trade openness	1.11	0.70	0.25	4.31
Monetary aggregates (% GDP)	106.56	132.24	16.58	967.79
Government expenditure (% GDP)	19.59	3.34	11.60	27.94
CPI (Constant=2010)	105.25	4.73	94.26	121.96
Banking crisis	0.17	0.38	0	1
Developing countries				
Output-side real GDP (mil USD)	291,774.07	656,308.76	419.81	5,409,044.23
Capital stock (mil. USD)	1,112,899.35	2,671,151.91	0.01	20,888,146.43
Number of persons engaged	15,893,694.99	49,510,247.18	43,170.85	537,834,899.90
China's ODI (Stock) (mil. USD)	5,025.75	49,946.24	0.12	981,265.68
Trade openness	0.84	0.52	0.14	4.43
Monetary aggregates (% GDP)	29.03	57.32	0.00	1,139.53
Government expenditure (% GDP)	16.28	7.42	4.21	61.95
CPI (Constant=2010)	172.91	1,510.59	78.01	48,981.99
Banking crisis	0.02	0.13	0	1

Table 2. Correlation matrix.

	LnChina	TO	MA	GEX	LnCPI	Crisis
LnChina	1.000					
TO	0.082	1.000				
MA	0.179	0.331	1.000			
GEX	-0.191	0.071	0.088	1.000		
LnCPI	0.181	-0.134	-0.121	-0.019	1.000	
Crisis	0.006	0.039	0.168	0.083	-0.124	1.000

Note: TO=Trade openness, MA=Monetary aggregate, GEX=Government expenditures.

Table 3 presents the efficiency scores based on full samples from developed and developing countries. This paper first estimates the efficiency score of the samples without including any correlates to determine the efficiency level of the countries with different levels of development. The results found developed countries are 13.3% more efficient as compared to developing economies in the base model. This may be due to the higher level of human capital and technology in developed economies as compared to developing countries. Then, China's ODI is included as one of the factors that could affect the efficiency level of the sample countries. To overcome the effect of misspecification of variables, this paper further includes the control variables in estimating the efficiency score of the countries. The results presented in Table 3 show that China's ODI, together with the control variables, significantly improves the efficiency level in developing economies from 83.20% to 96.30% as compared to developed economies. This indicates that China's ODI and macroeconomic factors are crucial in boosting the efficiency of developing economies. The results are verified with the t-test for independent samples as presented in Table 4.

Table 3. Summary of efficiency score.

Model specification	Full sample	Developed	Developing
Base model	0.850	0.965	0.832
China ODI	0.829	0.950	0.794
China ODI and control variables	0.946	0.956	0.963

Table 4. T-test for independent samples (developed vs developing).

Model specification	T-statistics
Base model	24.607***
China ODI	25.271***
China ODI and control variables	-1.671*

Note: *** and * represent significant at 1% and 10% level respectively.

To further examine the trend of China's ODI in developed and developing economies, this paper further disaggregates the data into yearly data (refer to Table 5). The developing countries were found to have higher efficiency scores prior to 2012. This requires attention from the host economies, where the inflow of China's ODI into developing countries after the BRI implementation resulted in a lower efficiency level. This may be due to the fact that State-Owned Enterprises and private companies started to put in a huge amount of investment into the developing countries along the BRI route in support of the BRI without a proper feasibility study done on the host economies, subsequently resulting in underutilization of resources in the host countries.

Table 5. Technical efficiency scores by year.

Year	Full sample			Developed			Developing		
	Without China	With China	Full model	Without China	With China	Full model	Without China	With China	Full model
2009	0.946	0.939	0.940	0.943	0.945	0.911	0.940	0.933	0.978
2010	0.942	0.924	0.951	0.959	0.962	0.924	0.932	0.903	0.979
2011	0.936	0.922	0.957	0.967	0.951	0.924	0.930	0.900	0.982
2012	0.891	0.877	0.956	0.960	0.941	0.968	0.885	0.855	0.976
2013	0.853	0.834	0.953	0.961	0.935	0.968	0.842	0.804	0.971
2014	0.813	0.785	0.947	0.962	0.935	0.973	0.797	0.744	0.965
2015	0.782	0.754	0.939	0.972	0.959	0.977	0.752	0.700	0.948
2016	0.759	0.731	0.936	0.975	0.959	0.979	0.725	0.675	0.937
2017	0.743	0.714	0.936	0.984	0.961	0.980	0.703	0.652	0.930

In addition, the lower efficiency level after 2013 might also be due to the lower-end level of China's current investment fields and investment industries, which mainly focus on labor-intensive industries that do not require highly skilled labors (Wang & Lin, 2019). This resulted in a lower level of efficiency over the years as there was no

improvement in terms of human capital or technological advancement. Moreover, the shortfalls in terms of worker's welfare often resulted in labor tensions, which may, in this case, lead to a reduction in efficiency in the host countries over time (Wang & Lin, 2019). These require urgent attention from China and the host countries to create a win-win situation in the long-run to ensure sustainable investment for the firms from China and the recipient countries.

This paper estimated the impact of China's ODI on host economies using SFA based on Cobb-Douglas and Translog specifications to reaffirm the role of China's ODI on the efficiency level. The paper first estimates the base model of the SFA and gradually adds the correlates of the efficiency, starting from our variable of interest, China's ODI (*LnChina*). The results in our analysis suggest that China's ODI reduced the inefficiency in both Cobb-Douglas and Translog specifications at the 1% significance level (refer to Table 6). The impact of China's ODI holds even after we take into account all the control variables in the model. The results indicate that China's ODI in general is conducive to improving the resource allocation in the recipient countries. This is consistent with the results of Cheng et al. (2020) research on China's ODI impact on total factor productivity. Consistently, the results can conclude that ODI from China reduced the inefficiency of the recipient countries in the world.

Table 6. Estimated results of stochastic frontier analysis (full sample).

Model	Cobb-Douglas			Translog		
	Without China	With China	Full model	Without China	With China	Full model
lnK	0.532*** (0.000)	0.570*** (0.000)	0.613*** (0.025)	0.179*** (0.000)	-0.683*** (0.000)	-0.025 (0.249)
LnL	-0.272*** (0.000)	-0.399*** (0.000)	-0.519*** (0.051)	0.299*** (0.000)	1.730*** (0.000)	-0.711 (0.487)
LnK^2	-	-	-	0.006*** (0.000)	0.056*** (0.000)	-0.037*** (0.008)
LnL^2	-	-	-	0.018*** (0.000)	0.031*** (0.000)	-0.137*** (0.022)
LnKL	-	-	-	0.007*** (0.000)	-0.078*** (0.000)	0.166*** (0.021)
Correlates						
LnODI	-	-0.201*** (0.003)	-0.601*** (0.064)	-	-0.156*** (0.000)	-0.494*** (0.054)
TO	-	-	-2.269*** (0.381)	-	-	-1.583*** (0.376)
MA	-	-	-0.160*** (0.029)	-	-	-0.150*** (0.021)
GEX	-	-	-0.060*** (0.020)	-	-	-0.036* (0.019)
LnCPI	-	-	2.330*** (0.290)	-	-	1.797*** (0.244)
Crisis	-	-	-24.510 (803.723)	-	-	-1.796*** (2.791)
sigma_u	0.134*** (0.004)	-	-	0.182*** (0.005)	-	-
sigma_v	0.000 (0.000)	0.000 (0.000)	0. 093*** (0.003)	0.000 (0.000)	0.000 (0.000)	0.088 (0.003)
E(sigma_u)	-	0.154	0.076	-	0.232	0.083
Log likelihood	1383.391	1295.446	1113.616	960.485	716.669	1150.423
No. obs.	1368	1368	1368	1368	1368	1368

Note: *** and * represent significant at 1% and 10% level respectively.

Due to the differential motivation of China' ODI in developed and developing economies, we further estimate the impact of China's ODI on developed and developing economies. This is because the motivation of China's ODI will lead to differences in the allocation of resources in the recipient countries. Table 7 presents the impact of China's ODI on developed countries. The estimated findings imply that the role of Chinese investments in developed economies is

rather benign after taking into consideration all the macroeconomic factors of the countries. The results appear to be insignificant in the translog function as compared to the estimated results for developing countries (refer to Table 8). This is consistent with the theory of marginal industrial expansion by Kojima, which states FDI is a means for industrial transfer in which the home country should transfer the industries that they are comparatively in advantage of to the host countries (Chen & Chen, 2015).

This may explain arguments about the insignificant outcome of China's investment in developed economies as compared to in developing countries.

Furthermore, the cultural gap between China and the developed countries further explains the insignificant effect of China's ODI in the developed countries. Compared to investments made in developing countries, the Chinese firms in developed economies have a shorter history of investment and are faced with massive social, cultural, legal, etc. issues (Zhang, 2018).

For example, there are differences in management practices and organizational culture between the Western world and the Chinese. The component of work-life balance is greater in Western countries as compared to the Chinese, who strive for longer working hours to show their work commitment.

In addition, strong labor laws and labor unions in developed countries may also prevent Chinese firms from operating in their full capacity, as they are used to doing in developing countries. It can be witnessed that the employees' benefits, such as employee insurance, vacations, and vocational training, in developed economies such as Germany, Britain, France, Italy, etc., contributed to higher costs for the Chinese firms. This may result in an increase in the cost of production and a slowdown in firms' production until the firms adjust themselves to the differences in organizational culture. Thus, Zhang (2018) further suggests that a continuous understanding of each other's cultural differences enables both countries to improve in terms of efficiency in investment and reduce the risks of investment.

Intellectual property (IP) protection and national security issues also served as the major factors that affected the allocation of resources by Chinese firms in developed countries, hence contributing to a lower efficiency level in aggregate. For example, the Committee on Foreign Investment in the United States (CFIUS) critically reviewed the investments in the United States that have a clear impact on national security, particularly telecommunications and manufacturing, which restricted the activities of the Chinese ODI in the United States. In fact, companies such as Huawei, Lenovo, ZTE Corporation, and Haier faced multiple IP infringement lawsuits, especially in developed economies (Zhang, 2018).

Additionally, the rapid development and growth in the export of low-cost high-speed rail technology from China have affected the commercial interests of some technologically powerful enterprises. Then, according to Zhang (2018), there will be accusations and legal action regarding patent infringements of Chinese high-speed railway technology .

Conversely, the results suggest that China's ODI to developing countries contributes to the reduction of inefficiency, being valid at the 1% significance level (refer to Table 8). The results support the important role of FDI as an important source of capital for domestic firms' businesses and technology expansion in developing countries, given the limited funding.

Hence, the results support the notion that FDI from China is believed to produce positive spillover effects on the host economies, especially in developing countries (Fu et al., 2020; Kong et al., 2020). These are in line with results by Adegboye, Osabohien, Olokoyo, and Matthew (2020), where FDI creates high-quality employments and increases domestic savings and investments that eventually boost productive efficiency in the host economy.

Table 7. Estimated results of stochastic frontier analysis (Developed countries).

Model	Cobb-Douglas			Translog		
	Without China	With China	Full model	Without China	With China	Full model
lnK	0.145***	-0.344***	-0.242	4.251***	1.057*	11.640***
	(0.000)	(0.000)	(0.210)	(0.000)	(0.544)	(1.926)
LnL	1.017***	1.277***	1.771***	-2.058***	2.794***	-2.551
	(0.000)	(0.000)	(0.421)	(0.000)	(0.757)	(3.374)
LnK^2	-	-	-	-0.131***	-0.016*	-0.382***
				(0.000)	(0.010)	(0.084)
LnL^2	-	-	-	-0.090***	-0.049**	-0.460***
				(0.000)	(0.024)	(0.086)
LnKL	-	-	-	0.215***	-0.023***	0.601***
				(0.000)	(0.005)	(0.175)
Correlates						
LnChina	-	-0.245***	-0.184*	-	-0.302***	-0.200
		(0.006)	(0.096)		(0.011)	(0.201)
TO	-	-	-6.254**	-	-	-0.393
			(2.882)			(0.692)
MA	-	-	-0.076	-	-	0.006*
			(0.052)			(0.003)
GEX	-	-	0.365*	-	-	-0.054
			(0.205)			(0.102)
LnCPI	-	-	1.178	-	-	-0.459
			(30.824)			(0.852)
Crisis	-	-	-0.361	-	-	2.948
			(1.427)			(3.540)
sigma_u	0.067***	-	-	0.037***	-	-
	(0.004)			(0.002)		
sigma_v	0.000	0.000	0.056***	0.000	0.021***	0.086***
	(0.000)	(0.000)	(0.008)	(0.000)	(0.004)	(0.014)
E(sigma_u)		0.101	0.038		0.060	0.059
Log likelihood	542.617	433.565	430.092	730.900	503.650	305.785
No. Obs.	318	318	318	318	318	318

Note: ***, ** and * represent significant at 1%, 5% and 10% level respectively.

From another point of view, the significant contribution of China's ODI to developing economies might be due to the smaller technological gap between China and the developing countries. Knowledge learning in low-technology sectors is less costly and allows Chinese multinational firms to neutralize the competitive advantages of technological leaders, especially in developing countries, thus contributing to higher efficiency in the production function. In fact, the inflows of capital to developing economies inevitably boost domestic savings and investment, consequently leading to a higher level of efficiency (Javorcik, 2015).

Moreover, the catching-up effects are relatively easier with fewer resources, which could further contribute to the improvement in efficiency after the inception of China's ODI in developing countries (Aykut & Goldstein, 2007; Fu et al., 2018). Similarly, Fu et al. (2020) suggest a smaller technological gap between China's ODI and that of developing countries leads to a greater efficiency level due to the absorptive capabilities of the host country. This is consistent with the findings in this paper that a higher efficiency level is part of the contribution from the effectiveness of the technology spillover effects from China. In this context, firms in low-income countries found themselves more capable of mastering the technology transfer from China, which subsequently led to a higher level of efficiency as compared to developed countries. This is supported by the results by Seyoum et al. (2015) in their study to investigate the technology spillovers of Chinese multinational firms in Ethiopia. They found that domestic firms with a smaller technology gap with China can benefit from positive spillovers, whereas firms with low absorptive capacity witness negative spillovers.

Table 8. Estimated results of stochastic frontier analysis (Developing countries).

Model	Cobb-Douglas			Translog		
	Without China	With China	Full model	Without China	With China	Full model
lnK	0.609*** (0.000)	0.659*** (0.000)	0.699*** (0.025)	0.181*** (0.000)	-1.212*** (0.000)	0.185 (0.390)
LnL	-0.364*** (0.000)	-0.493*** (0.000)	-0.578*** (0.053)	0.295*** (0.000)	1.687*** (0.000)	0.300 (0.770)
LnK^2	-	-	-	0.006*** (0.000)	0.047*** (0.000)	0.006 (0.014)
LnL^2	-	-	-	0.018*** (0.000)	-0.038*** (0.000)	0.018 (0.047)
LnKL	-	-	-	0.007*** (0.000)	0.020*** (0.000)	0.006 (0.032)
Correlates						
LnChina	-	-0.193*** (0.003)	-0.436*** (0.088)	-	-0.133*** (0.000)	-0.189*** (0.061)
TO	-	-	-19.225*** (3.646)	-	-	-16.008*** (3.175)
MA	-	-	-0.068* (0.040)	-	-	-0.034* (0.021)
GEX	-	-	0.078* (0.042)	-	-	0.061* (0.034)
LnCPI	-	-	2.080*** (0.390)	-	-	1.199*** (0.256)
Crisis	-	-	-22.436 (769.304)	-	-	-119.664 (554.670)
sigma_u	0.145*** (0.004)	-	-	0.208*** (0.006)	-	-
sigma_v	0.000 (0.000)	0.000 (0.000)	0.111*** (0.003)	0.000 (0.000)	0.000 (0.000)	0.153*** (0.018)
E(sigma_u)		0.166	0.028		0.289	0.054
Log likelihood	977.278	913.265	784.895	598.880	309.478	428.995
No. obs.	1050	1050	1050	1050	1050	1050

Note: *** and * represent significant at 1% and 10% level respectively.

Our findings are supported by Fu et al. (2020), where China's ODI is observed to have a significant effect on capital accumulation in developing countries as compared to ODI from the United States. This is especially true when the Chinese ODI seems to have bigger effect on capital accumulation in developing countries as compared to ODI from the United States. This is especially true when the Chinese ODI seems to have a bigger effect on employment and productivity growth as compared to the ODI from the United States, supporting our results on the significant impact of China's ODI in developing countries. Furthermore, Fu et al. (2020) highlighted that the effect of ODI on the host economies depends largely on the relative terms where ODI from China may yield a positive impact on host economies as both home and host economies are matched with the appropriate compatibilities in terms of capital, labor, or technology. Apart from that, emerging economies are endowed with great potential in terms of economic growth. The developing countries are furnished with young and large populations as well as vast land areas that have contributed to a large number of labor forces that reduce the cost of production, which may further contribute to the positive impact of China's ODI in these countries. Moreover, most of the countries are resource-rich countries with major producers of agricultural products. In fact, there is a large untapped market for China's products, thus creating a huge opportunity for China to create demand and increase the level of demand for China's products in developing economies. This serves as an attraction for China's ODI in developing countries that enables them to realize higher returns, hence contributing to a higher efficiency level in these countries (Huang & Zheng, 2014).

During the internationalization exploratory phase, Chinese companies sought to invest in underdeveloped nations with lax rules. This is because developing nations are more eager to push the economic frontier higher due

to a lower threshold for technological access, making it easier for the businesses to obtain the support of the host authorities and avoid trade obstacles. Comparing this to developed countries results in lower technical hurdles and looser product criteria. As a result, this lowers the cost of doing business, which boosts Chinese companies' productivity in the recipient economies and has a beneficial knock-on impact. Additionally, the information and communications technology (ICT) backward nations drew investment from companies like Huawei, which made a substantial contribution to the technological improvement of these developing nations' digital economies. Apart from that, from a political or international relations point of view, establishing good relations between China and those third-world countries like South Asia, Middle Asia, Africa, and the Latin American countries (Xi, 2014) is crucial to overcome the domination of trade by the developed economies. Consequently, the host country's government may protect the dissatisfactions about the investment in order to facilitate investment opportunities with China. This can be seen in the strong political ties where 14 countries (eight in Africa, the rest in South Asia and West Asia, South America, and Europe, and most of them are developing countries in the world) are being described as "all-weather friends". The report by Li (2015) stated that the Chinese government cancelled about 11 billion yuan of debts owed by African nations, and more than 10 billion yuan had been promised and was in the process of debt cancellation in 2007. In 2009, China once again promised to continue the increment of assistance to Africa, reduce or cancel the debts of African nations, and expand trading and ODI with them within its capability. These indirectly contributed to better trade relations among the developing economies with China. Such a relationship could have been transformed into a better facilitation of trade and investment in the host countries, thereby enabling Chinese firms to have more flexibility to decide on the usage of their resources and technology to be invested in these countries. Consequently, this might contribute to the overall increase in efficiency of the host countries as a result of China's ODI..

5. CONCLUSION

China's influence on the global economy is undeniable. The recent pandemic outbreak and the lockdown in China had a significant impact on the global supply chain. Due to China's status as the world's second-largest investor and the abrupt halt of Chinese tourism, the global economy is all but immobilized. Therefore, it is essential to research the economic impact of Chinese investment. Given the paucity of research in this field, we performed an empirical analysis to determine how China's ODI affects the economic efficiency of the recipient nations.

Our findings imply that the appropriateness of ODI depends on the suitability of FDI for local conditions, which is an important factor in boosting the level of efficiency. Our results are consistent with the FDI-growth nexus, where FDI into developing economies greatly enhances the productivity and efficiency of the countries, given their constraints on getting funding for economic development. Besides that, the appropriateness of foreign technology in relation to local economic and socio-technical conditions greatly affects the spillover effects of FDI in the host economies (Fu et al., 2020). Therefore, these results suggest a new perspective on the role of ODI on economic growth, defying the theoretical view that FDI must come from more advanced economies for positive spillover effects to take place. Our findings indicate that a smaller technological gap between China's ODI and the developing countries leads to a higher level of efficiency, mainly due to better absorptive capabilities. We recommend careful planning and implementation of policies, with in-depth discussions on the requirements between the host economies and China, to reap the actual benefits of ODI in pushing towards a higher economic frontier.

While this study provides valuable insights about China's external direct investment (ODI) in the global economy, it could be useful to acknowledge the limitations of our investigation when debating the role that technology transfer plays in FDI. Therefore, we suggest that future studies examine ODI's role in technology transfer to the host economy in greater detail. Furthermore, the effects of ODI on the host economy may go beyond focusing only on economic growth and efficiency to include their contribution to sustainable development and the mitigation of climate change.

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REFERENCES

Adegboye, F. B., Osabohien, R., Olokoyo, F. O., & Matthew, O. A. (2020). Foreign direct investment, globalisation challenges and economic development: An African Sub-regional analysis. *International Journal of Trade and Global Markets*, *13*(4), 414-433. https://doi.org/10.1504/ijtgm.2020.111124

Aigner, D., Lovell, C. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, *6*(1), 21-37. https://doi.org/10.1016/0304-4076(77)90052-5

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: The role of local financial markets. *Journal of International Economics*, *64*(1), 89-112. https://doi.org/10.1016/s0022-1996(03)00081-3

Aykut, D., & Goldstein, A. (2007). *Developing country multinationals: South-South investment comes of age*. OECD Working Paper No. 257.

Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, *20*(2), 325-332. https://doi.org/10.1007/bf01205442

Blomström, M., & Kokko, A. (1998). Multinational corporations and spillovers. *Journal of Economic Surveys*, *12*(3), 247-277. https://doi.org/10.1111/1467-6419.00056

Buckley, P. J., Clegg, L. J., Cross, A. R., Liu, X., Voss, H., & Zheng, P. (2009). The determinants of Chinese outward foreign direct investment. *Journal of International Business Studies*, *40*(2), 353-354.

Cai, X., Zhao, Y., Wu, X., Ge, D., & Long, X. (2023). The green halo effect of China's OFDI: Evidence from countries along the Belt and road. *Environmental Science and Pollution Research*, *30*(26), 68290-68312. https://doi.org/10.1007/s11356-023-27202-y

Chan, S. G., & Har, W. M. (2021). *Impact of China investment on employment in Malaysia manufacturing sector*. Paper presented at the 5th Network of ASEAN-China Academic Institutes (NACAI) International Symposium, December 2021.

Chen, E., & Chen, B. (2015). Location selection and influencing factors of Z Hongguo's direct investment in developing countries. *Journal of International Economic Cooperation*, *2015*(8), 14-20.

Chen, J., Liu, Y., & Liu, W. (2020). Investment facilitation and China's outward foreign direct investment along the belt and road. *China Economic Review*, *61*, 101458. https://doi.org/10.1016/j.chieco.2020.101458

Chen, W., Dollar, D., & Tang, H. (2018). Why is China investing in Africa? Evidence from the firm level. *The World Bank Economic Review*, *32*(3), 610-632.

Cheng, H., Wang, Z., Peng, D., & Kong, Q. (2020). Firm's outward foreign direct investment and efficiency loss of factor price distortion: Evidence from Chinese firms. *International Review of Economics & Finance*, *67*, 176-188. https://doi.org/10.1016/j.iref.2020.01.008

Deng, P. (2004). Outward investment by Chinese MNCs: Motivations and implications. *Business Horizons*, *47*(3), 8-16. https://doi.org/10.1016/s0007-6813(04)00023-0

Findlay, R. (1978). Relative backwardness, direct foreign investment, and the transfer of technology: A simple dynamic model. *The Quarterly Journal of Economics*, *92*(1), 1-16. https://doi.org/10.2307/1885996

Fu, X., Buckley, P. J., & Fu, X. M. (2020). The growth impact of Chinese direct investment on host developing countries. *International Business Review*, *29*(2), 101658. https://doi.org/10.1016/j.ibusrev.2019.101658

Fu, X., Hou, J., & Liu, X. (2018). Unpacking the relationship between outward direct investment and innovation performance: Evidence from Chinese firms. *World Development, 102*, 111-123. https://doi.org/10.1016/j.worlddev.2017.09.021

Greene, W. (2005). Reconsidering heterogeneity in panel data estimators of the stochastic frontier model. *Journal of Econometrics, 126*(2), 269-303. https://doi.org/10.1016/j.jeconom.2004.05.003

Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review, 35*(2-3), 517-526. https://doi.org/10.1016/0014-2921(91)90153-a

Guo, X., & Wang, J. (2023). Outward foreign direct investment, green financial development, and green total factor productivity: Evidence from China. *Environmental Science and Pollution Research, 30*(16), 47485-47500. https://doi.org/10.1007/s11356-023-25651-z

Halkos, E. G., & Tzeremes, N. G. (2009). Electricity generation and economic efficiency: Panel data evidence from world and East Asian countries. *Global Economic Review, 38*(3), 251-263. https://doi.org/10.1080/12265080903157300

Halkos, G. E., & Tzeremes, N. G. (2009). Exploring the existence of Kuznets curve in countries' environmental efficiency using DEA window analysis. *Ecological Economics, 68*(7), 2168-2176. https://doi.org/10.1016/j.ecolecon.2009.02.018

Hanemann, T., & Huotari, M. (2017). *Record flows and growing imbalances: Chinese investment in Europe in 2016. MERICS Papers On China Update.* Retrieved from https://merics.org/sites/default/files/2020-04/Chinese%20investment%20in%20Europe%20-%20record%20flows%20and%20growing%20imbalances.pdf

Hjalmarsson, L., Kumbhakar, S. C., & Heshmati, A. (1996). DEA, DFA and SFA: A comparison. *Journal of Productivity Analysis, 7*, 303-327. https://doi.org/10.1007/bf00157046

Huang, M., & Zheng, Y. (2014). The trade structure and comparative advantages of Chinese manufactured products exported to Africa. *World Economy and Trade, 2014*(5), 4-9.

Javorcik, B. S. (2015). Does FDI bring good jobs to host countries? *The World Bank Research Observer, 30*(1), 74-94. https://doi.org/10.1093/wbro/lku010

Jin, G., & Huang, Z. (2023). Asymmetric influence of China's outward FDI and exports on trade-adjusted resources footprint in belt and road node countries: Moderating role of governance. *Resources Policy, 82*, 103558. https://doi.org/10.1016/j.resourpol.2023.103558

Khan, S. M., & Arora, K. (2017). Scope of India's and China's investment in African continent. *Procedia Computer Science, 122*, 691-697. https://doi.org/10.1016/j.procs.2017.11.425

Kolstad, I., & Wiig, A. (2012). What determines Chinese outward FDI? *Journal of World Business, 47*(1), 26-34. https://doi.org/10.1016/j.jwb.2010.10.017

Kong, Q., Guo, R., Wang, Y., Sui, X., & Zhou, S. (2020). Home-country environment and firms' outward foreign direct investment decision: Evidence from Chinese firms. *Economic Modelling, 85*, 390-399. https://doi.org/10.1016/j.econmod.2019.11.014

Kumbhakar, S. C., & Lovell, K. C. A. (2000). *Stochastic frontier analysis.* New York: Cambridge University Press.

Li, J. (2015). *Looking at the world, which countries are China's "all-weather friends"?* Retrieved from https://news.sina.cn/2015-12-07/detail-ifxmhqac0090322.d.html

Li, X., & Liu, X. (2005). Foreign direct investment and economic growth: An increasingly endogenous relationship. *World Development, 33*(3), 393-407. https://doi.org/10.1016/j.worlddev.2004.11.001

Liu, X., Buck, T., & Shu, C. (2005). Chinese economic development, the next stage: Outward FDI? *International Business Review, 14*(1), 97-115. https://doi.org/10.1016/j.ibusrev.2004.12.003

Meeusen, W., & Van Den Broeck, J. (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. *International Economic Review, 18*(2), 435-444. https://doi.org/10.2307/2525757

Meunier, S. (2012). *Political impact of Chinese foreign direct investment in the European union on transatlantic relations. European Parliament Briefing Paper.* Retrieved from https://spia.princeton.edu/system/files/research/documents/meunier_political_impact_of_chinese_foreign_direct_investment.pdf

Ministry of Commerce People Republic of China (CMC). (2021). *2021 statistical bulletin of China's outward foreign direct investment*. Beijing: China Commerce and Trade Press.

Pan, Y. (2018). Investment risk and countermeasures in emerging economies. *Globe Biweekly*, *2018*(2), 20-23.

Peyrouse, S. (2016). Discussing China: Sinophilia and sinophobia in Central Asia. *Journal of Eurasian Studies*, *7*(1), 14-23. https://doi.org/10.1016/j.euras.2015.10.003

Qi, C. (1999). The situation on direct investment abroad by China and its reasons: On investment in Hong Kong from China. *Economic Science*, *1999*(2), 34-40.

Qiao, J. (1996). Chinese enterprises overseas investment. *Investment Research*, *1996*(2), 16-22.

Ramamurthi, R., & Singh, J. V. (2009). *Emerging multinationals in emerging markets*. Cambridge: Cambridge University Press.

Ramasamy, B., Yeung, M., & Laforet, S. (2012). China's outward foreign direct investment: Location choice and firm ownership. *Journal of World Business*, *47*(1), 17-25. https://doi.org/10.1016/j.jwb.2010.10.016

Seyoum, M., Wu, R., & Yang, L. (2015). Technology spillovers from Chinese outward direct investment: The case of Ethiopia. *China Economic Review*, *33*, 35-49. https://doi.org/10.1016/j.chieco.2015.01.005

Simar, L., & Wilson, P. W. (2007). Estimation and inference in two-stage, semi-parametric models of production processes. *Journal of Econometrics*, *136*(1), 31-64. https://doi.org/10.1016/j.jeconom.2005.07.009

Suliman, A. H., Elian, M. I., & Ali, H. E. (2018). Endogenous specification of FDI and economic growth: Cross-economies' evidence. *International Journal of Business*, *23*(1), 89-109.

Wang, C., & Wang, L. (2023). Can outward foreign direct investment improve China's green economic efficiency? *Environmental Science and Pollution Research*, *30*(13), 37295-37309. https://doi.org/10.1007/s11356-022-24823-7

Wang, Y., & Lin, N. (2019). The performance index and influencing factors of countries along the belt and road in attracting China's direct investment-based: A comparative study of investment data between China and the United States. *Finance and Accounting for International Commerce*, *2019*(4), 12-18.

Wu, H.-L., & Chen, C.-H. (2001). An assessment of outward foreign direct investment from China's transitional economy. *Europe-Asia Studies*, *53*(8), 1235-1254. https://doi.org/10.1080/09668130120093219

Xi, J. (2014). *The governance of China* (Vol. 1). Beijing: The Foreign Languages Press.

Xu, B. (2000). Multinational enterprises, technology diffusion, and host country productivity growth. *Journal of Development Economics*, *62*(2), 477-493. https://doi.org/10.1016/s0304-3878(00)00093-6

Yao, S., Zhang, F., Wang, P., & Luo, D. (2017). Location determinants of China's outward foreign direct investment. *China & World Economy*, *25*(6), 1-27. https://doi.org/10.1111/cwe.12218

Zenglein, M. J. (2020). *Mapping and recalibrating Europe's economic interdependence with China. MERICS Report, November 17*. Retrieved from https://merics.org/en/report/mapping-and-recalibrating-europes-economic-interdependence-china

Zhang, J. (2018). Investment risk and countermeasures in developed countries. *Globe Biweekly*, *2018*(2), 16-19.

Zhang, X., & Daly, K. (2011). The determinants of China's outward foreign direct investment. *Emerging Markets Review*, *12*(4), 389-398.

APPENDIX

Appendix-1a. List of samples of developed countries.

No.	Country	Sample period	No.	Country	Sample period
1	Australia	2009-2017	19	Japan	2009-2017
2	Austria	2009-2017	20	Latvia	2009-2017
3	Belgium	2009-2017	21	Lithuania	2009-2017
4	Bulgaria	2009-2017	22	Luxembourg	2009-2017
5	Canada	2009-2017	23	Malta	2009-2017
6	Croatia	2009-2017	24	Netherlands	2009-2017
7	Cyprus	2009-2017	25	New Zealand	2009-2017
8	Czech Republic	2009-2017	26	Norway	2009-2017
9	Denmark	2009-2017	27	Poland	2009-2017
10	Estonia	2009-2017	28	Portugal	2009-2017
11	Finland	2009-2017	29	Romania	2009-2017
12	France	2009-2017	30	Slovak Republic	2009-2017
13	Germany	2009-2017	31	Slovenia	2009-2017
14	Greece	2009-2017	32	Spain	2009-2017
15	Hungary	2009-2017	33	Sweden	2009-2017
16	Iceland	2015-2017	34	Switzerland	2009-2017
17	Ireland	2009-2017	35	United Kingdom	2009-2017
18	Italy	2009-2017	36	United States	2009-2017

Appendix-1b. List of samples of developing countries.

No.	Country	Sample period	No.	Country	Sample period
1	Albania	2009-2017	36	Egypt	2009-2017
2	Algeria	2009-2017	37	Equatorial Guinea	2009-2017
3	Angola	2009-2017	38	Ethiopia	2009-2017
4	Argentina	2009-2017	39	Fiji	2009-2017
5	Armenia, Republic of	2009-2017	40	Gabon	2009-2017
6	Azerbaijan, Republic of	2009-2017	41	Gambia	2009-2017
7	Bahamas	2009-2017	42	Georgia	2009-2017
8	Bahrain, Kingdom of	2014-2017	43	Ghana	2009-2017
9	Bangladesh	2009-2017	44	Grenada	2009-2017
10	Belarus	2009-2017	45	Guatemala	2014-2017
11	Belize	2014-2016	46	Guinea	2009-2017
12	Benin	2009-2017	47	Guinea-Bissau	2009-2017
13	Bolivia	2009-2017	48	India	2009-2017
14	Bosnia and Herzegovina	2009-2017	49	Indonesia	2009-2017
15	Botswana	2009-2017	50	Iran	2009-2017
16	Brazil	2009-2017	51	Iraq	2009-2017
17	Brunei	2009-2017	52	Israel	2009-2017
18	Burundi	2009-2017	53	Jamaica	2009-2017
19	Cambodia	2009-2017	54	Jordan	2009-2017
20	Cameroon	2009-2017	55	Kazakhstan	2009-2017
21	Cape Verde	2009-2017	56	Kenya	2009-2017
22	Central African	2009-2017	57	Korea, Republic of	2009-2017
23	Chad	2009-2017	58	Kuwait	2009-2017
24	Chile	2009-2017	59	Kyrgyz Republic	2009-2017
25	China, P.R.: Hong Kong	2009-2017	60	Lebanon	2009-2017
26	China, P.R.: Macao	2009-2017	61	Lesotho	2009-2017
27	Colombia	2009-2017	62	Liberia	2009-2017
28	Comoros	2009-2017	63	Macedonia, FYR	2009-2017
29	Congo	2009-2017	64	Madagascar	2009-2017
30	Congo, DR	2009-2017	65	Malawi	2009-2017
31	Costa Rica	2009-2017	66	Malaysia	2009-2017
32	Cote d'Ivoire	2009-2017	67	Maldives	2013-2017
33	Djibouti	2013-2017	68	Mali	2009-2017
34	Dominican	2009-2017	69	Mauritania	2009-2017
35	Ecuador	2009-2017	70	Mauritius	2009-2017

Continue….

No.	Country	Sample period	No.	Country	Sample period
71	Mexico	2009-2017	96	Seychelles	2009-2017
72	Moldova	2009-2017	97	Sierra Leone	2009-2017
73	Mongolia	2009-2017	98	Singapore	2009-2017
74	Montenegro	2010-2017	99	South Africa	2009-2017
75	Morocco	2009-2017	100	Sri Lanka	2009-2017
76	Mozambique	2009-2017	101	St Vincent and Grenadines	2009-2017
77	Myanmar	2009-2017	102	Sudan	2009-2017
78	Namibia	2009-2017	103	Taiwan	2009-2017
79	Nepal	2009-2017	104	Tajikistan	2009-2017
80	Nicaragua	2013-2017	105	Tanzania	2009-2017
81	Niger	2009-2017	106	Thailand	2009-2017
82	Nigeria	2009-2017	107	Togo	2009-2017
83	Oman	2009-2017	108	Trinidad and Tobago	2009-2017
84	Pakistan	2009-2017	109	Tunisia	2009-2017
85	Panama	2009-2017	110	Turkey	2009-2017
86	Paraguay	2009-2017	111	Uganda	2009-2017
87	Peru	2009-2017	112	Ukraine	2009-2017
88	Philippines	2009-2017	113	United Arab Emirates	2009-2017
89	Qatar	2009-2017	114	Uruguay	2009-2017
90	Russian Federation	2009-2017	115	Uzbekistan	2009-2017
91	Rwanda	2009-2017	116	Venezuela, República Bolivariana de	2009-2017
92	Sao Tome and Principe	2010-2017	117	Vietnam	2009-2017
93	Saudi Arabia	2009-2017	118	Yemen	2009-2017
94	Senegal	2009-2017	119	Zambia	2009-2017
95	Republic of Serbia	2009-2017	120	Zimbabwe	2009-2017

Note: China is officially known as People's Republic of China, where "P.R." stand for "People's Republic" in this paper. Similarly, "DR" stand for "Democratic Republic" as Congo is officially known as Democratic Republic of the Congo. "FYP" stand for "Former Yugoslav Republic" as Macedonia is known as Former Yugoslav Republic of Macedonia before officially changing its name to "Republic of North Macedonia" in 2019.