

## EFFICIENCY ANALYSIS OF CHINA'S OUTWARD FOREIGN DIRECT INVESTMENT IN ASEAN COUNTRIES

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### **Abstract**

*This study aims to compute the efficiency scores of China's ODI in ASEAN countries over the period from 2005 to 2016 and identify the inefficiency determinants that affect the efficiency scores. A stochastic frontier gravity model was employed in the study. The overall performance of China's ODI in ASEAN countries is at inefficiency level, meanwhile the low performance of China's ODI indicated a higher potential level to improve. The second-stage analysis is a panel model regression to identify the inefficiency determinants by using the efficiency scores that derived from first-stage analysis as the dependent variable. The variables used in the second-stage analysis are language, voice and accountability, political stability, government effectiveness, regulation quality, rule of law, and control of corruption. The results showed language, voice and accountability, regulation quality, rule of law, and control of corruption are statistically significant towards the efficiency scores. ASEAN countries are recommended to enhance their government ability thus improve the regulation quality and rule of law.*

**Keywords:** *Efficiency, China's ODI, Inefficiency, ASEAN, Stochastic Frontier Gravity Model, Second stage analysis*

## 1. INTRODUCTION

According to Fan, Zhang, Liu, and Pan (2016), whether the initiative that China was currently conducting can be beneficial for its ODI depends on the performance of the ODI and its determinants. However, as a relative newcomer to global ODI market, the performance and potential of China's ODI in ASEAN remain uncertain. More to the point, there is lack of the efficiency study on China's ODI in ASEAN. According to UNCTAD (2017), FDI remains as the largest and least volatile of a key source of finance for developing economies. In fact, after the Global Financial Crisis in the year 2008, global ODI shows a sluggish trend. At present, the global ODI recovery remains bumpy, where both developed and developing economies contributed a weak ODI flow (UNCTAD, 2017). In such situation, China plays a crucial role in the developing economies, because it has surpassed Japan became second largest ODI contributor, and the expansion of China's ODI never stopped after the crisis

As a relative newcomer of ODI contributor, there is a gap between China and those developed economies regarding the aspect of quality investment. According to Jiang and Liu (2018), China facing several issues such as inequal distribution of investment area, prominent investment risk, and slow upgrading of investment industry structure. For instance, the total share of China's ODI allocated to ASEAN countries who involved in China's "Belt and Road" initiative has a significant dropped. In other words, this proven the uneven distribution of investment area, where Asia region is the largest China's ODI recipient but its sub-region, ASEAN only received the smaller portion of China's ODI.

According to UNCTAD (2017), the geopolitical risk and political uncertainty might hamper the recovery of global FDI. In the meantime, geopolitical uncertainty is one of the main macroeconomic factors that agreed by most MNE's executives that it would lead to a decrease in FDI flow globally (UNCTAD, 2017). Besides that, according to Tong, Singh, and Li (2018), host country with a good macro-corporate governance structure has a positive impact on China's ODI decision making. In other

words, host-country with a relatively stable political environment will attract more China's ODI. In fact, regional instability remains a serious concern for ASEAN countries, where ASEAN countries facing internal struggles such as crisis of Rohingya Refugees, South China Sea dispute, IMDB scandal in Malaysia, Pattani insurgency in Thailand, and terrorism in the Philippines (Kurniawan, 2017). Moreover, investing behaviour of China's MNEs is largely affected by the variation of policy (Tong, Singh, & Li, 2018). Therefore, these political instability situations and policy variation are believed will impacting the FDI inflow in ASEAN and affecting the efficiency of China's ODI in ASEAN as well.

The purpose of our study is to examine the performance and potential of China's ODI by assessing the efficiency of China's ODI. Next, inefficiency determinants are able to identify the magnitude to which the initiative implementing by China government can improve China's ODI. Therefore, this study attempts to compute the efficiency score of China's ODI in each ASEAN member and identify the inefficiency determinants that affect efficiency score by employing a stochastic frontier gravity model. This paper is organized as follows. Section 2 discusses the methodology, theoretical and empirical models. Section 3 presents the empirical findings and discussion of the analysis. Section 4 presents the recommendations and conclusion.

## **2. LITERATURE REVIEW**

In order to access the efficiency score of China's ODI in ASEAN countries, the author needs to define what ODI efficiency in this study is. Indeed, in existing study, ODI efficiency could also refers to FDI efficiency (Armstrong, 2011; Fan et al., 2016; Mourao, 2018) or macro-level investment efficiency (Jiang & Liu, 2018). However, there is lack of the scholars have defined on FDI efficiency or macro-level investment efficiency. Therefore, before defines what ODI efficiency is, there is a need to first explain what efficiency is. According to Farrell (1957), in a firm context, efficiency refers to the success in producing large amount of an

output by given a set of inputs. In fact, efficiency can be defined as the rate of actual value to potential value (Kalirajan and Shand, 1999).

The study by Farrell (1957) claims that the efficiency has two components, which are allocative efficiency and technical efficiency. In this study, the present study following the previous studies (Armstrong, 2011; Fan et al., 2016; Jiang & Liu, 2018; Mourao, 2018) that uses the technical efficiency as ODI efficiency. Therefore, the author defined ODI efficiency as the ratio between the actual level of ODI and the potential level of ODI that from a given set of inputs. In a simple word, the author will compute an output-oriented technical efficiency which using a set of inputs with an output (Kumbhakar & Tsionas, 2006). Moreover, a number of studies have indicated that ODI efficiency is used to explain the performance and potential of ODI (Armstrong, 2011; Fan et al., 2016; Jiang & Liu, 2018; Mourao, 2018), where a lower ODI efficiency means the lower ODI performance, but at the same time, it has a higher potential to further improve.

According to Armstrong (2011), there is no any model that widely used to explain the FDI flows, meanwhile, unlike the international trade having the theoretical model such as gravity trade model, FDI does not have any FDI model that theoretical underpinnings of. However, the strong interdependencies between FDI and international trade led to a considerable number of studies in which using gravity trade model to explain the flow of FDI, and surprisingly those model applications are relatively successful (Armstrong 2011).

Besides that, the study by Fan et al (2016) has supported the above statement which claimed that gravity model is widely used to explain bilateral FDI flows among different geographical economies. In fact, according to Hai and Thang (2017), the conventional gravity model could be biased due to the model unable to control the resistances (inefficiency factors) that under unobserved disturbance term. Therefore, a stochastic

frontier gravity model was introduced to solve the problem (Hai & Thang, 2017).

### 3. METHODOLOGY

#### 3.1 Stochastic Frontier Analysis

Stochastic frontier gravity model refers to the integration between stochastic frontier analysis and the gravity model. In a simple form, the stochastic frontier analysis is a methodology that applied to estimate a gravity model. Stochastic frontier analysis is developed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). According to Kumbhakar and Tsionas (2006), it is a parametric econometric analysis that estimate the production function or technical efficiency.

The stochastic frontier analysis focus on two components which it will derive a stochastic production frontier that act as the benchmark against the efficiency scores is measured, and a one-sided non-negative error term that which follows an independent and identical normal distribution across observations to capture inefficiency term across production units (Aigner, Lovell, & Schmidt, 1977). The stochastic frontier analysis has two common estimation methods, which are maximum likelihood estimation and methods of moments (Maurao, 2018).

In the present study, the author will use the maximum likelihood estimation in stochastic frontier analysis instead of methods of moments. The reason behind is that the present study having 120 observations but methods of moment is used to indicating small number of sample size ( $n < 25$ ). Therefore, the maximum likelihood estimation is preferred because it allows a larger sample observation (Maurao, 2018).

As the second-stage analysis of this study follows Armstrong (2011) that using the panel OLS method to estimate the equation (8), so that the author will discuss the panel regression method in this subsection. According Gujarati and Porter (2009), there are three types of panel model to regress

the panel data estimation, which are Pooled OLS regression (POLS), Fixed Effect Model (FEM), and Random Effect Model (REM).

$$FDI_{ijt}^* = f(x_{ijt}, \beta) \exp(v_{ijt}) \quad (1)$$

The technical efficiency of FDI undertaken by country  $i$  to country  $j$  over the  $t$  period is defined as

$$TE_{ijt} = \frac{FDI_{ijt}}{FDI_{ijt}^*} = \exp(-u_{ijt})$$

(2)

When  $TE \in [0,1]$  measures FDI's efficiency level. High-efficiency scores suggest ODI from home economy to host economy is reaching closely to its maximum level of potential, while low-efficiency scores are implying the room of potential to strengthen regional integration between home and host economy further

Besides, equation (2) shows that TE is a function of the one-sided inefficiency element. As the results, if  $u_{ijt} = 0$ , means the actual FDI lies on the frontier due to there are no any frictions of FDI from home to host economy. However, if  $u_{ijt} > 0$ , means that the actual level of FDI falls short of the frontier level, where indicated there are investment resistances to FDI.

Indeed, equation (1) can be transformed into a linear equation which written as:

$$\ln FDI_{ijt} = \ln f(x_{ijt}, \beta) + v_{ijt} - u_{ijt}, \quad u_{ijt} \geq 0 \quad (3)$$

To explain the FDI inefficiency, a technical inefficiency model is written as below:

$$\exp(-u_{ijt}) =$$

$$z_{ijt} \delta \varepsilon_{ijt}$$

(4)

Where,

$\delta$  is a vector of unknown coefficients;

$z_{ijt}$  is a vector of explanatory variables associated with FDI's technical inefficiency over time;

$\varepsilon_{ijt}$  is the random error which is defined by the truncation normal distribution. The point of truncation is  $-\alpha \cdot z_{ijt}$ , for example:  $\varepsilon_{ijt} > -\alpha \cdot z_{ijt}$

Lastly, a full linear stochastic frontier gravity model for FDI from country  $i$  and country  $j$  can be written as below by combining equation (3) and (4):

$$\ln FDI_{ijt} = \ln f(x_{ijt}, \beta) + v_{ijt} - (\alpha \cdot z_{ijt} + \varepsilon_{ijt}) \quad (5)$$

### 3.2 Two Stage Analysis

The two-stage approach actually is separated the stochastic frontier gravity model into two parts. The first part of the model to compute the efficiency scores of China's ODI in ASEAN countries, while the second part of the model to identify the inefficiency factors (investment resistances) that affect the efficiency scores of China's ODI.

First-Stage Model as follows:

$$nODI_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 RGD_{ijt} + \beta_4 \ln GDPPC_{it} + \beta_5 \ln GDPPC_{jt} + \beta_6 RNR_{ijt} + \beta_7 Contig_{ijt} + v_{ijt} - u_{ijt}$$

(6)

$ODI_{ijt}$  = the ODI flow from China to host country  $j$  over the  $t$  period.

$GDP_{it}$  and  $GDP_{jt}$  = China's GDP and each ASEAN country's GDP respectively.

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$RGD_{ijt}$  = the relative geographic distance between China and ASEAN countries.

$GDP_{PC_{it}}$  and  $GDP_{PC_{jt}}$  = China's GDP per capita and each ASEAN country's GDP per capita respectively.

$Contig_{ijt}$  = a dummy variable that to indicate whether China and host country  $j$  are contiguous.

$v_{ijt}$  and  $u_{ijt}$  = two-sided error element and the one-sided inefficiency element respectively.

The second-stage model as follows:

$$\begin{aligned} \exp(u_{ijt}) = & \delta_0 + \delta_1 Lang_{ijt} + \delta_2 VA_{jt} + \delta_3 PS_{jt} + \delta_4 GE_{jt} + \delta_5 RQ_{jt} \\ & + \delta_6 ROL_{jt} + \delta_7 CC_{jt} \\ & + \varepsilon_{ijt} \end{aligned} \tag{7}$$

Where,

$Lang_{ijt}$  = dummy variable, Language.

$VA_{jt}$  = Voice and Accountability of host country  $j$ .

$PS_{jt}$  = Political Stability of host country  $j$ .

$GE_{jt}$  = Government Effectiveness of host country  $j$ .

$RQ_{jt}$  = Regulation Quality of host country  $j$ .

$ROL_{jt}$  = Rule of Law of host country  $j$ .

$CC_{jt}$  = Control of Corruption of host country  $j$ .

$\varepsilon_{ijt}$  = error term.

### 3.3 Data Description

The dataset used in this study divides into two sets of determinants to support the two-stage approach that will be conduct in following chapter Data for this were retrieved from World Bank.

. The first set of data, namely frontier determinants which use for first-stage analysis to compute the efficiency scores of China's ODI in ASEAN countries. While the second set of data, namely inefficiency determinants which will use for the second-stage analysis to identify the inefficiency factors (investment resistances) that will affect the efficiency scores of China's ODI. Data for this were retrieved from World Bank.

#### 4. RESULTS AND DISCUSSION

The two-stage approach is allowed to use in the present study is because of the advantage of stochastic frontier analysis which distinct the error term to non-negative error term and normal disturbance. The non-negative error term captures the inefficiency terms, so that it can be used to construct the empirical model for second-stage analysis. From the first-stage analysis, the efficiency scores of China's ODI has been computed by using *Frontier 4.1 software*.

A set of frontier determinants (output and inputs) that used to compute the efficiency score are China's ODI flows (output), China's GDP (input), GDP of host country (input), relative geographical distance (input), China's GDP per capita (input), GDP per capita of host country (input), relative natural resources (input), and ontiguous (input). Based on the result, the overall efficiency score of China's ODI in ASEAN countries over the period 2005 to 2016 is 0.3494 which achieved at the inefficiency level (rank 7). This result shows the performance of China's ODI in ASEAN countries over the years is lower, but there is high potential of China's ODI in ASEAN

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Mean	0.381	0.305	0.372	0.333	0.362	0.403	0.325	0.306	0.326	0.329	0.338	0.407
Min	0.137	0.000	0.105	0.210	0.233	0.132	0.105	0.059	0.097	0.119	0.074	0.070
Max	0.781	0.473	0.552	0.470	0.463	0.637	0.494	0.516	0.609	0.581	0.592	0.725

countries in future because it has not achieved at frontier level yet.

Table 1: Efficiency Scores of China's ODI in ASEAN Countries, 2005-2016

Table 1 shown that the lowest China's ODI efficiency score fall in 2006 ( $Mean_a = 0.3059$ ), while the highest China's ODI efficiency score achieved in 2016 ( $Mean_a = 0.4076$ ). However, both under the category of inefficiency level. Malaysia is the ASEAN country that has the highest China's ODI efficiency score ( $Mean_b = 0.5371$ ) which achieved at low efficiency level (rank 6), while the ASEAN country that has the lowest China's ODI performance is Myanmar ( $Mean_b = 0.2270$ ) which under the category of inefficiency level (rank 7). Moreover, the ASEAN country that repeated to has the lowest China's ODI efficiency score is Philippines and Brunei, while Malaysia and Thailand are the countries that repeated to has the highest efficiency scores of China's ODI. From the second-stage analysis, the efficiency score computed in the first-stage analysis became the dependent variable and using *Eviews 10 software* to estimate the panel model. A set of inefficiency determinants (independent variables) that will affect the efficiency score are introduced which are language, voice and accountability, political stability, government effectiveness, regulation quality, rule of law, and control of corruption.

Table 2: POLS Model Estimation Result

Variable	Coefficient	t-value	p-value
Constant ( $\delta_0$ )	0.2280*** (0.0450)	5.0625	0.0000
Language ( $Lang_{ijt}$ )	0.1126** (0.04890)	2.3019	0.0232
Voice and Accountability ( $VA_{jt}$ )	-0.1207*** (0.03729)	-3.2375	0.0016
Political Stability ( $PS_{jt}$ )	-0.0335 (0.02653)	-1.2618	0.2096
Government	-0.0513	-0.6641	0.5080

Effectiveness ( $GE_{jt}$ )	(0.07723)		
Regulation Quality ( $RQ_{jt}$ )	0.1102** (0.05568)	1.9797	0.0502
Rule of Law ( $ROL_{jt}$ )	0.3430*** (0.1123)	3.0557	0.0028
Control of Corruption ( $CC_{jt}$ )	-0.3016*** (0.05566)	-5.4197	0.0000
$R^2$	0.3305	F-Statistics	7.8973
Adjusted $R^2$	0.2886	Prob (F-Statistics)	0.0000
Durbin-Watson Statistics	1.6488	Observation	120

Based on the result shown in Table 2, language, voice and accountability, regulation quality, rule of law, and control of corruption are statistically significant to affect the efficiency scores of China's ODI in ASEAN countries except for political stability and government effectiveness. Language, regulation quality, and rule of law showed a positive sign which are indicates that common languages shared by China and host countries, high regulation quality and stronger rule of law can improve the efficiency score of China's ODI in ASEAN countries through the reduction of economic distance that improve the bilateral FDI activities.

Furthermore, the voice and accountability and control of corruption showed a negative coefficient are the surprising result in the present study. Most of the time, people are thinking the country that having the best governance environment will attract more FDI allocation. In fact, the multinational enterprises might avoid the country that has the democracy constraint that caused by higher score of voice and accountability. Meanwhile, they might bribes the host country under certain circumstances to circumvent regulations that burdensome and obstacles of bureaucratic which probably

explain the higher score of control of corruption that associate lower performance of China's ODI.

## 5. CONCLUSION

Based on the findings, the overall efficiency scores of China's ODI in ASEAN countries is fall at inefficiency level. In other words, there is a higher potential of China's ODI in ASEAN countries can be improve through the adjustment or improvement on the respective policies of China and ASEAN countries based on the inefficiency determinants that have been identified in the present study. Governance indicators like regulation quality and rule of law have positive influence towards efficiency scores of China's ODI in ASEAN countries as well. It is no doubt that a country that has a sound legal system can increase the confident level of investor. As the regulation quality and rule of law used is from the host country (ASEAN countries), so that the author the following policy suggestion is for ASEAN countries. The core concern of regulation quality and rule of law is about the government's ability to implement and enforce the law and regulations. The keyword here is the ability of the government because a good quality and enforceable laws or policy changes is decision by each respective government. Therefore, ASEAN countries needs to enhance their government abilities for further improve in their legal system.

When the government's ability is high then its control of implementation and enforceability will be increase simultaneously. After the enhancement of government's ability, then ASEAN countries should focus and revise their law and regulations once is outdated or any vulnerability exposure. The world is changing every day which same goals to the changing of society behaviour. There is no a perfect law and regulation that no need to revise. Therefore, as the change of business environment and behaviour, the law and regulation should be re-examining and revise according to the realistic to protect the citizens and businesses. Not only that, the government of ASEAN countries must strictly enforce the law and regulations to shape the country in a good manner. As a result, the country who has a stronger

regulation quality and rule of law will increase the confident level of investor as they feel be protected in the country thus encouraged ODI.

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