EFFICIENCY ANALYSIS OF CHINA'S OUTWARD FOREIGN DIRECT INVESTMENT IN ASEAN COUNTRIES: AN APPLICATION OF STOCHASTIC FRONTIER GRAVITY MODEL

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BY

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DECLARATION

I hereby declare that:

(1) This undergraduate research project is the end result of my own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) All contribution has been made by myself in completing the research project.

(4) The word count of this research report is approximately 13304 words.

Name of student:	Student ID:	Signature:
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Date: ______________________

ACKNOWLEDGEMENT

"The more decisions that you are forced to make alone, the more you are aware of your freedom to choose."

— Thornton Wilder

This final year project symbolises a milestone in my university life. In particular, I decided to complete my final year project alone instead of follows the tradition that produces it by a group. This decision is meaningful to me as I put this as a challenge that I wish to accomplish before graduating from UTAR. A solo player does not mean that he lost the support and backup, in fact, I had indebted to many persons in completing my final year project.

With this opportunity, I would like to express my sincerest gratitude to my supervisor, Dr Vikniswari a/p Vija Kumaran for her willingness to accept me as her supervisee. Her patience and motivation like a lighthouse in a storm which always leads me to a right path. I deeply appreciate her kindness and passion for teaching, and I would not be able to complete my project without her guidance and support.

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Most importantly, my deepest gratitude goes to my parent and brothers. Without them, I would not be alive and enjoying my life. Lastly, I would like to thank Renee, my girlfriend for her accompanying and encouragement, and blessing all the friends that supported me during my university life.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

ACFTA	ASEAN-CHINA Free Trade Area
ASEAN	Association of Southeast Asian Nations
BP-LM	Breusch-Pagan Lagrange Multiplier
CAEXPO	CHINA-ASEAN EXPO
CEPII	Centre for International Prospective Studies and Information
FDI	Foreign Direct Investment
FEM	Fixed Effect Model
GDP	Gross Domestic Product
MNEs	Multinational Enterprises
ODI	Outward Foreign Direct Investment
OLS	Ordinary Least Square
POLS	Pooled Ordinary Least Square
REM	Random Effect Model
SFA	Stochastic Frontier Analysis
WDI	World Development Indicator
WGI	World Governance Indicator

LIST OF APPENDICES

Page

ABSTRACT

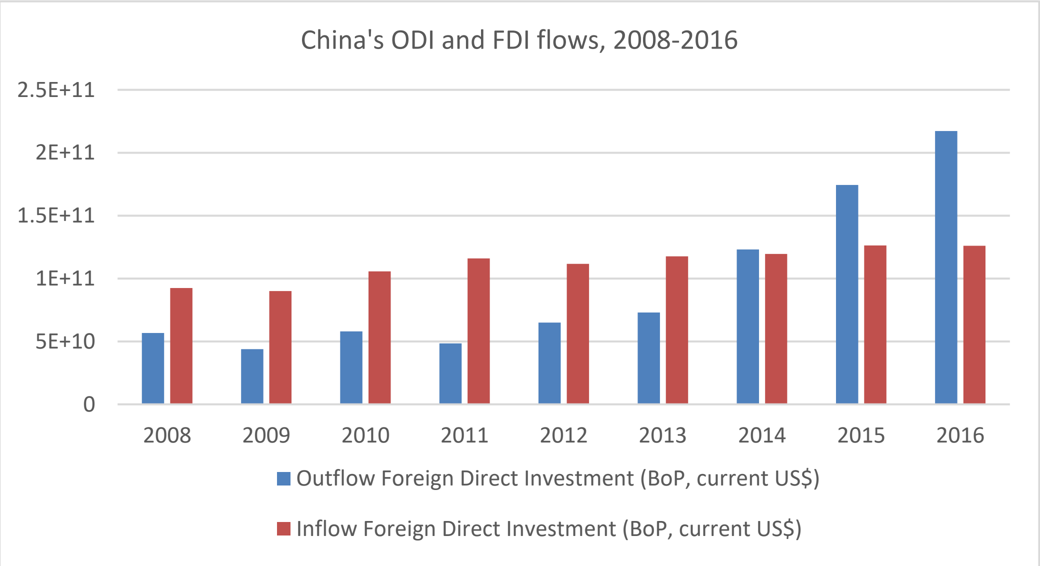
This study aims to compute the efficiency scores of China's ODI in ASEAN countries over the period from 2005 to 2016 and identify the inefficiency determinants that affect the efficiency scores. A stochastic frontier gravity model was employed in the study. The two-stage approach that adopted from Armstrong (2011) has separated the stochastic frontier gravity model into two part. The first first-stage analysis is used to compute efficiency score by using a set of inputs with an output. The output was China's ODI, while inputs are China's GDP, GDP of each ASEAN countries, China's GDP per capita, GDP per capita of each ASEAN countries, relative geographical distance, relative natural resources, and contiguous. 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. Therefore, China is suggested to allocate more ODI in ASEAN countries. 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 POLS model is preferred in this study and estimation results showed language, voice and accountability, regulation quality, rule of law, and control of corruption are statistically significant towards the efficiency scores. In short, ASEAN countries is recommended promote Mandarin in their education system, and enhance their government ability thus improve the regulation quality and rule of law. Thus, host country that have good image and reputation will increase the investment from China's MNEs.

CHAPTER 1: INTRODUCTION

1.0 Research Overview

The rise of China has drawn the worldwide attention over the past decades. Foreign Direct Investment (FDI) of China, both inward and outward, is a critical dimension that reflects its global economic engagement and integration (Armstrong, 2011). Developed countries are the main contributor of Outward Foreign Direct Investment (ODI) for a long time. However, the ODI flows from emerging market economies are now noticeable. In particular, China's Outward Foreign Direct Investment (ODI) was almost non-existent before its economic reform, but it has increased and exceeded its inbound FDI for the first time in the year 2014 (as shown in Figure 1.1).

Figure 1.1: *China's ODI and FDI Flows, from 2008 to 2016*

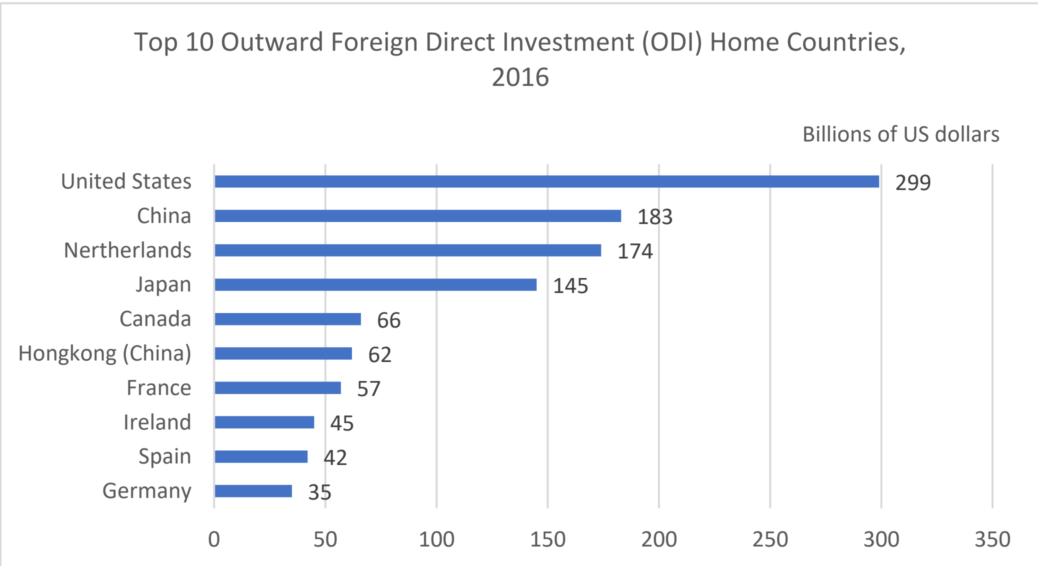


Source: *National Bureau of Statistics of China, 2018*

The stunning expansion of China's ODI has indicates that China's economy entering a new expansion cycle which transited from a "receiver" to an "investor" (KPMG, 2018). Besides that, the rapid growth of China's ODI has shown China's economic prosperity (Tong, Singh & Li 2018). In other words, it indicated China's growing global presence and its economic influences to the worldwide.

According to UNCTAD (2017), China is currently rated as the world second-largest ODI investor, which its ODI in the year 2016 reached $183 billion, behind only the United States (as shows in Figure 1.2). The sharp development of China's ODI is attributed to China adopted "Going Global Strategy" in the year 2001. China's "Going Global Strategy" encouraged domestic Multinational Enterprises (MNEs) take part in the cross-border investment to support China's economic integration globally.

Figure 1.2: *Top 10 ODI Home Countries, 2016*

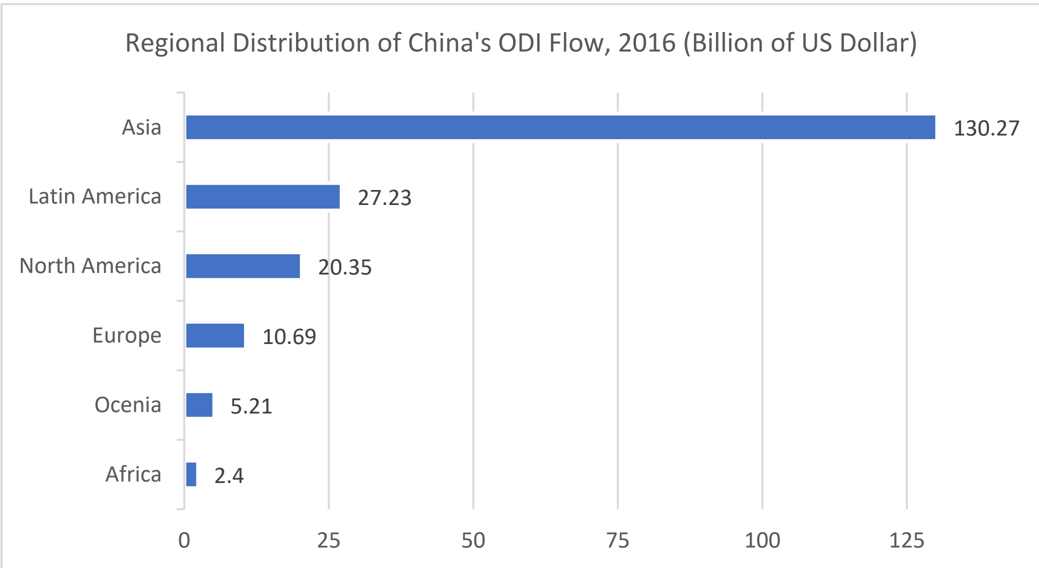


Source: *UNCTAD, 2017*

In late 2013, China's President, Xi Jing Ping announced "Belt and Road" initiative that aims to promote the in-depth regional collaboration among Asia, Europe, and Africa region. China's "Belt and Road" initiative which believed is an upgrade from the previous "Going Global Strategy", where explore new fields of collaboration and speed up the investment cooperation between China and other regions (Wang & Zhao, 2017).

In addition, Asia region currently is the largest China's ODI recipient, followed by Europe and Africa region (as shows in Figure 1.3). As a representative of Southeast Asia, Association of Southeast Asian Nations (ASEAN) is an important economic entity in Asia region. Meanwhile, the economic cooperation between China and ASEAN have marked over the decades. Indeed, China is not only a key investor to ASEAN and it also as the largest trading partner of most of the ASEAN members (Foo, 2017). According to Mckidney (2018), ASEAN would be achieved as the world seven-largest economy if it is a single country. Apparently, as a strategic partner, ASEAN has shown its economic importance to China, and more to the point mutually beneficial occurred between China and ASEAN.

Figure 1.3: *Regional Distribution of China's ODI, 2016*



Source: *Statistical Bulletin of China's Outward Foreign Direct Investment, 2016*

Therefore, whether the initiative that currently conducted can beneficial to the investment cooperation between China and ASEAN is a concern for China. 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.

In response to the above concern, there is a desire 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.

1.1 Research Background

This section is to have a brief understanding towards China (Home Country) and ASEAN (Host Countries) regarding their historical background, economic development, and nation's outlook.

1.1.1 The Background of China

The People's Republic of China or called as China is currently as the world second-largest economy. China located in East Asia region with a population of 1.3 billion (World Bank, 2018). Since initiating the economic reform with Open Door Policy in the year 1979, China has experienced the rapid economic growth over the past thirty years. The reform and open-up policy has liberalised China's financial and trade market. Likewise, China in the late 1999s launched "Going Global" strategy which encourages its outbound investment through guided their domestic firm to find resources and market abroad (China Policy, 2017). The "Going Global Strategy" was believed that it would supported China's economic integration globally

Today, China not only surpassed United States became the world largest FDI recipient, and in fact, some claimed that based on the purchasing power parity measurement, China actually stood at world largest economy (Central Intelligence Agency, 2018). Besides that, according to Roach (2016), China acts as a single largest contributor to world's Gross Domestic Production (GDP). It is clear that despite China remains as a developing economy, but its growing economic power had made China acting as a global leadership role which is significantly impacting the global economy.

Moreover, economic globalisation occurred had urged China government to launch "Going Global 2.0" strategy to achieve sustainable development goals. According to (China Policy, 2017), the emerging of "Going Global 2.0" aims to address the previous failings and ensure China's MNEs has invested abroad wisely, with greater concern for domestic sensibilities and image of China. Particularly, the well-known "Belt and Road" initiative is part of the "Going Global 2.0" to express the geopolitical (China Policy, 2017). Therefore, it is believed that "Belt and Road" initiative able to strengthen China's economic position through promoting the in-depth regional collaboration.

1.1.2 The Background of ASEAN

In the year 1967, The Association of Southeast Asian Nations, or called ASEAN, was established in Bangkok, Thailand. According to Nesadurai (2008), initially, there are only five-member states are joined in ASEAN, namely Malaysia, Singapore, Indonesia, Philippines, and Thailand. Therefore, these five countries are also recognised as the Founding Father of ASEAN (ASEAN,2017). In addition, ASEAN currently has expanded to ten-member states where the other five-member states are Brunei Darussalam (joined in the year 1984), Lao PDR and Myanmar (joined in the year 1997), and Cambodia (joined in the year 1999).

According to Nesadurai (2008), ASEAN Declaration (Bangkok Declaration) has stated that the aims of ASEAN formed are to promote the regional stability and accelerate the economic growth through joint endeavours. At the same time, ASEAN promoting an active collaboration and mutual assistance to each member states that will improve the living standard of people and maintain a prosperous and peaceful environment.

The ASEAN is an exclusive regional economic community of its kind outside the America and Europe region. The ASEAN consists of a combined population of more than $ 622 million which is larger than Europe and North America (Breene, 2017). Today, ASEAN while being the world largest economy zone and it is also recognised as a significant global hub for manufacturing and trade activities (Mckinsey, 2018). In the meantime, according to (Breene, 2017), ASEAN's labour force is rated as world third-largest, behind only the China and India.

The economic potential of ASEAN shown in its performance of inflow FDI. According to Ryan (2014), ASEAN overtook China became the world largest FDI recipient for the first time in the year 2014. In addition, ASEAN is able to become world seven-largest economy with a combined Gross Domestic Production (GDP) of $2.6 billion (Breene, 2017). While ASEAN as a powerful economic community, but in fact, the development gap between each member state remains larger (Glass, 2013). Therefore, a deeper integration between ASEAN member states has to be conducted which is believed will boost their economic ties and improve region's competitiveness (Glass, 2013)

1.2 Overview of China-ASEAN Dialogue Relations

It is necessary to look at China-ASEAN relations to further illustrate the diplomatic relationship between China and ASEAN countries, as well as China's growing global presence and economic influences in ASEAN countries in particular.

In July 1999, China-ASEAN dialogue relations commenced when Mr. Qian Qi Chen, Foreign Minister of the People's Republic of China attended 24th ASEAN Ministerial Meeting as a guest in which he expressed China have interest to collaboration with ASEAN in the (ASEAN, 2017). Afterwards, China was conferred on full Dialogue Partner in the year 1996 (ASEAN, 2017). In October

2003, the relationship between China and ASEAN moved up to a new phase where they signed the Joint Declaration of the Heads of State/Government on Strategic Partnership for Peace and Prosperity at 7th ASEAN-China Summit in Bali, Indonesia. (ASEAN, 2017). In addition, according to (ASEAN, 2017), China is the first dialogue partner for ASEAN countries.

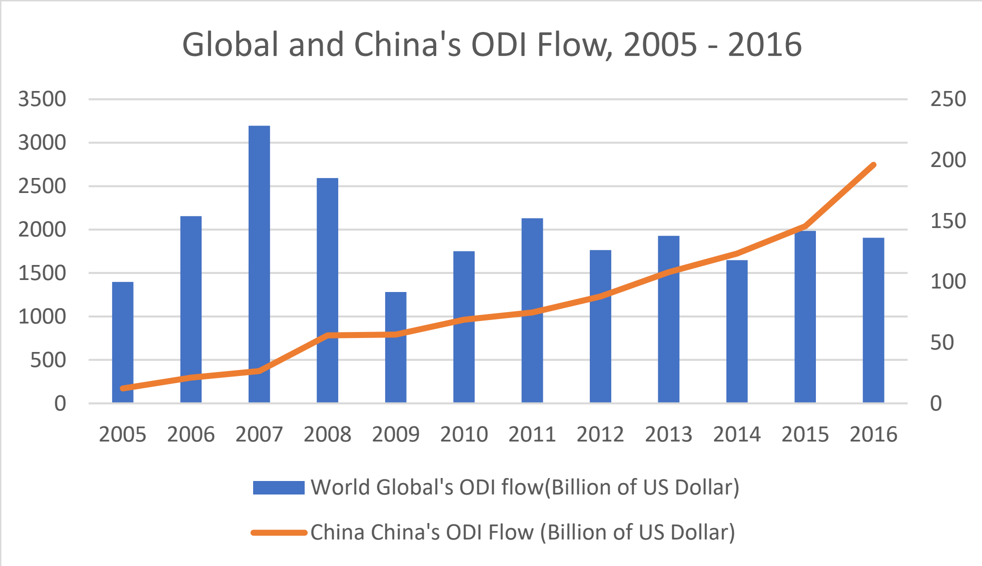
According to ASEAN (2017), ASEAN and China will enhance their strategic partnership through regular discussion and dialogues such as ASEAN-China Summit and ASEAN-China Ministerial Meeting. Besides that, the growing trade and economic ties between China and ASEAN countries occurred where China is the largest trading partner for ASEAN since the year 2009 and also act as the fourth largest FDI contributor to ASEAN (ASEAN, 2017).

Moreover, there are some economic cooperation have announced between China and ASEAN such as ASEAN-China Free Trade Area (ACFTA) in the year 2002, annual ASEAN-China EXPO (CAEXPO) since the year 2004, as well as ASEAN involved in China's "Belt and Road" initiative. Those collaborations are able to encourage the active involvement of mutual trade and investment, meanwhile, strengthen both sides relation.

1.3 Problem Statement

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 shown in Figure 1.4).

Figure 1.4: *Global and China's ODI Flow, 2005 - 2016*



Source: *World Development Indicators & Statistical Bulletin of China*

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.

Table 1.1: *China's ODI Flow in Asia Region, 2015-2016*

Countries	Year 2015		Year 2016		Growth Rate of FDI Flow (%)
	FDI Outflow ($ billion)	Share (%)	FDI Outflow ($ billion)	Share (%)	
ASEAN	14.60	13.5	10.28	7.9	-29.59
Total (Asia)	108.37	100	130.27	100	20.21

Source: *Statistical Bulletin of China's Outward Foreign Direct Investment, 2016*

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 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.

1.4 Research Questions

This section drafts the research question based on the research background, problem statement, and research objective that mentioned above, where the foremost interest of this study is on the efficiency score that indicated the performance and potential of China's ODI in ASEAN countries, as well as the inefficiency determinants that affect the efficiency scores of China's ODI in ASEAN countries.

Based on the above, there are three questions drafted to further this study:

i) What is the efficiency score of China's ODI in each ASEAN member from 2005 to 2016?

ii) What are the inefficiency determinants that affect the efficiency scores of China's ODI in ASEAN countries from 2005 to 2016?

The present study is able to achieve the given research objectives by answering these two research questions. In the meantime, these research questions are believed to support a deeper investigation of this study.

1.5 Research Objectives

This section addresses the purpose of the study where outlines the general objective and the specific objectives of the study.

1.5.1 General Objective

This study aims to assess the efficiency scores of China's ODI in ASEAN countries and identify inefficiency determinants of China's ODI over the period from the year 2005 to the year 2016.

1.5.2 Specific Objectives

a) To examine the efficiency score of China's ODI in ASEAN countries from 2005 to 2016.
b) To identify the inefficiency determinants that influence efficiency score of China's ODI in ASEAN countries from 2005 to 2016.

1.6 Significance of Study

This study contributes to the existing literature in several areas. Firstly, it enriches the understanding of China's ODI to the extent that compute the efficiency of China's ODI in ASEAN countries. The efficiency scores are used to reflect the performance and potential of China's ODI in each ASEAN member. In fact, China's policy maker able to use these efficiency scores to make their FDI allocation adjustment and decision in ASEAN countries.

Secondly, this study contributed a set of inefficiency determinants which statistically significant for the China's ODI in ASEAN countries. Therefore, each ASEAN member who are interested to attract more China's ODI, they are able to find their impediments in attracting FDI regarding the list of determinants. In other words, this study also can help to expand the current literature of ASEAN's inbound FDI which differs from the previous studies that mostly focus on Africa and Europe regions.

Thirdly, even this study is concern on China's ODI, but undoubtful China having large economic influence in global economic landscape. Therefore, this study also provides the insight to other country's policy makers, academicians, investors, and analysts. Policy makers are able to adjust or amend their foreign and trade strategies to seek more closely cooperation with China. Academicians are able to use this study's information or method to further their in-depth study on China's ODI. While investors and analysts are able to avoid risky decision and analyse precisely based on the information provided by this study.

Lastly, this study provides a comprehensive way to compute the efficiency score of China's ODI and identify the inefficiency determinants that affect the efficiency score. Specifically, the comprehensive method used in this study is refers to the two-stage approach by Armstrong (2011). The two-stage approach also applicable for other country's ODI, therefore this approach can use to examine the efficiency score of different countries' ODI and enrich their ODI literature as well.

1.7 Scope of Study

This study focuses on assessing the efficiency of China's ODI in each ASEAN member and examining the inefficiency determinants of China's ODI in ASEAN countries. In this study, host country is limit to ASEAN countries. Precisely, there are 10 ASEAN countries and these 10 ASEAN countries are referring to Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The dataset of this study covers from the year 2005 until the year 2016, which total 12 years data. Moreover, this study adopts the two-stage approach to estimate a stochastic frontier gravity model. Regarding to two-stage approach, the first-stage analysis is to compute the efficiency scores of China's ODI in ASEAN countries by using stochastic frontier analysis, while the second-stage analysis is to identify the inefficiency determinants that affect the efficiency score of China's ODI in ASEAN countries (derived from first-stage analysis) by using panel ordinary least square (OLS) regression.

1.8 Structure of the Study

This study is divided into five chapters. The Chapter 1 introduces the rapid growth phenomenon of China's ODI and provides an essential understanding on the background of China, ASEAN, and their relation. In Chapter 2, a brief review of previous literature about the relevant theoretical and empirical literature for the study is provided. Next, Chapter 3 will map out the methodology used for the study, which will provide a description of the methods and dataset used as well as generate an empirical research model. Chapter 4 begins with a discussion which analysing and interpreting the empirical findings of the study. Chapter 5 will provide a discussion on policy implication regarding the research results, limitation of the study and end with the future research suggestions.

1.9 Chapter Conclusion

This chapter is an overall introduction to the study, where it started with discussing the phenomenon of China's ODI and the background of China and ASEAN. Next, the problem statement is carried out to describe the core issues of the study. Moreover, the research objective and question are provided to addresses the aims of the study. Lastly, this chapter also presents the significance and scope of the study where are discussing the contribution made and the boundary placed in the study. The study will continue to next chapter which is about the comprehensive literature review that related to the interest of the study.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The chapter reviews the previous literature that related to China's ODI which included past theoretical and empirical studies to build a strong foundation to further the investigation for the study. First, this chapter begins with the explanation of the efficiency concept and define what ODI efficiency is. Next, reviews on the FDI theoretical and the empirical model used in previous studies. Third, discuss the past empirical results. Last, this chapter will identify the research gap and make a conclusion for this chapter.

2.1 ODI Efficiency

In order to access the efficiency score of China's ODI in ASEAN countries, the present study 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, this study 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 present study 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.

2.2 Review of Theoretical Model

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). To have a better understanding on the conventional gravity model and the stochastic frontier gravity model, these two models has written and discuss as below:

2.2.1 Conventional Gravity Model

The gravity model was originally from the field of physics, which it was built based on Newton's law of universal gravitation. In the year 1687, Isaac Newton developed the law of universal gravitation to describe the gravitational force between two masses in relation to the distance that lies between them (Newton, 1687). The traditional gravity model is written as below:

$$F_{ij} = G\frac{M_i M_j}{d_{ij}^2}$$

Where,

$\boldsymbol{F_{ij}}$ represents the gravitational force that is proportional to the product of the two masses $\boldsymbol{M_i}$ and $\boldsymbol{M_j}$ and inversely proportional to the square of the distance, $\boldsymbol{d_{ij}^2}$ that keeps the two masses apart from each other. The gravitational constant $\boldsymbol{G}$ is an empirical determined value. This relationship is applicable to any context where the modelling of flows or movements is demanded.

In the year 1962, Jan Tinbergen, a Dutch economist inspired by Newton's law of universal gravitation that first applied the gravity model to the field of international economic (Fan et al, 2016). Tinbergen (1962) applied the gravity model to explain the bilateral trade flow, where he proposed a basic concept regarded to the gravity model of trade that economic size between two countries is positively influenced their bilateral trade flows, while the actual geographic distance between them is negatively impacted. In fact, the gravity model currently was widely used to explore the bilateral trade's determinants and effects as well as to measure its performance by assessing the differences between actual and potential trade flows (Armstrong, 2007).

According to Jiang and Liu (2018), even though the application of gravity model in the early stage is mainly focused on international trade only, but scholars then started applying it to the field of foreign direct investment. Brainard (1997) is believed as the first economist that applied the gravity model to estimate the bilateral flow. Today, the past studied have proven that gravity model can well approximated the bilateral FDI flows and it has been claimed as most frequently adopted specification in empirical studies of FDI (Blonigen, 2005). At the same time, according to Armstrong (2011) investment and trade are strongly interdependencies that lead gravity model successfully explaining FDI. The statement is supported by Fan et al (2016) which indicated that a strong foundation for employing gravity model to measure bilateral FDI flows had created through the numerous augmented versions of gravity models of FDI in the existing empirical studies.

2.2.2 Stochastic Frontier Gravity Model

A stochastic frontier gravity model is an integration of stochastic frontier analysis (SFA) and the conventional gravity model. Traditionally, SFA is used to assess the production efficiency and it is proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). According to Aigner, Lovell and Schmidt (1977), SFA approach advocates that the two distinct can influence the production process, so that the error term should separate into two components: non-negative error term, u_{ijt} and other random error term, v_{ijt}. In fact, the non-negative error term represents the inefficiency components or known as behind-the-border constraints (investment resistances or human-made resistances), while random error term captures others omitted error (Kalirajan, 2007).

According to Fan et al (2016), a general form of stochastic frontier gravity model can be written as:

$$FDI_{ijt} = f(x_{ijt}, \beta)\exp(v_{ijt})\exp(-u_{ijt}), \qquad u_{ijt} \geq 0 \tag{1}$$

Where,

$\boldsymbol{i}$, $\boldsymbol{j}$, and $\boldsymbol{t}$ represent the indexes of home economy, host economy, and period respectively.

$\boldsymbol{x_{ijt}}$ denotes the core variables that determine the frontier level of FDI.

$\boldsymbol{\beta}$ represents a vector of the unknown parameters to be estimated.

$\boldsymbol{v_{ijt}}$ represents a two-sided error element reflecting statistical noise due to measurement error, it is assumed to be $v_{ijt} \sim iid\ N(0, \sigma_v^2)$.

$\boldsymbol{u_{ijt}}$ is a one-sided inefficiency element representing a measure of the FDI performance. It is assumed independent distributed of random error, such that it is obtained by truncation normal distribution with the mean, $z_{ijt}\delta$, and the variance, σ_u^2 , where z_{ijt} denotes the explanatory variables associated with technical inefficiency of ODI, and δ is the corresponding set of parameters to be estimated.

The frontier level of FDI undertaken by country $\boldsymbol{i}$ to country $\boldsymbol{j}$ over the $\boldsymbol{t}$ period, $\boldsymbol{FDI_{ijt}^*}$, is defined by the following equation:

$$FDI_{ijt}^* = f(x_{ijt}, \beta)\exp(v_{ijt}) \quad (\mathbf{2})$$

The technical efficiency of FDI undertaken by country $\boldsymbol{i}$ to country $\boldsymbol{j}$ over the $\boldsymbol{t}$ period, $\boldsymbol{TE_{ijt}}$, is defined as

$$TE_{ijt} = \frac{FDI_{ijt}}{FDI_{ijt}^*} = \exp(-u_{ijt}) \quad (\mathbf{3})$$

When TE ∈ [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 (3) 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:

$$lnFDI_{ijt} = lnf(x_{ijt}, \beta) + v_{ijt} - u_{ijt}, \qquad u_{ijt} \geq 0 \quad (\mathbf{4})$$

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

$$\exp(-u_{ijt}) = z_{ijt}\delta\varepsilon_{ijt} \qquad \textbf{(5)}$$

Where,

$\boldsymbol{\delta}$ is a vector of unknown coefficients;

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

ε_{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 **(4)** and **(5)**:

$$lnFDI_{ijt} = lnf\left(x_{ijt}, \beta\right) + v_{ijt} - \left(\alpha \cdot z_{ijt} + \varepsilon_{ijt}\right) \qquad (\mathbf{6})$$

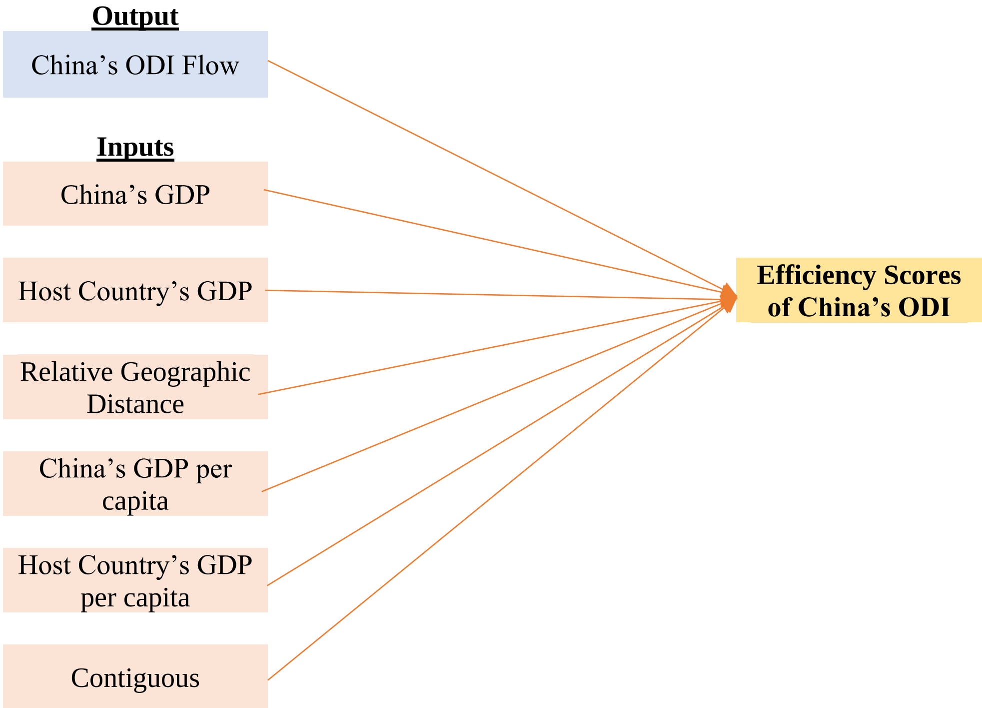
2.3 Research Framework

The present study adopts two-stage approach of Armstrong (2011) to estimate the stochastic frontier gravity model that discussed earlier. This section is to draft the research frameworks for the two objectives that mentioned earlier.

2.3.1 First-Stage Model

The First-Stage Model is used to answer the first objective which to compute efficiency scores of China's ODI in ASEAN countries. The research framework of first-stage model is shows as below:

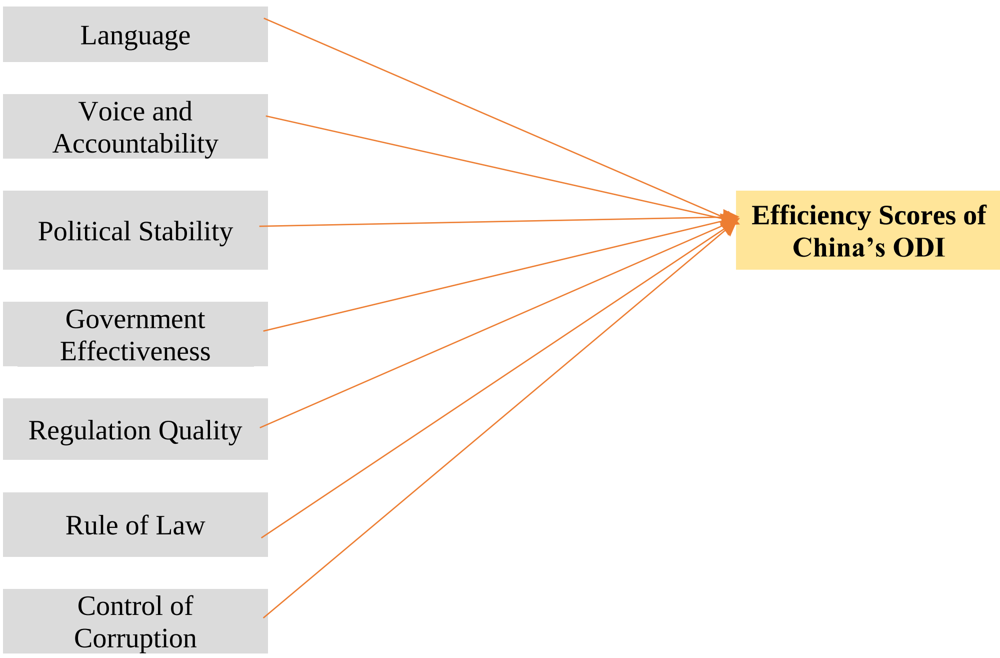
Figure 2.1: First-Stage Model



2.3.2 Second-Stage Model

The Second-Stage Model is used to answer the second objectives which to identify the inefficiency determinants that affect the efficiency scores of China's ODI in ASEAN countries.

Figure 2.2: Second-Stage Model



2.4 Frontier Determinants for First-Stage Model

As mentioned earlier, ODI efficiency refers to output-oriented technical efficiency. So that, to compute the efficiency scores, it requires a set of inputs with an output (also refers frontier determinants). This section is to discuss the inputs and output that used in previous studies.

2.4.1 China's ODI (Output)

China's ODI was chosen to as an output in previous studies, because it acts as a dependent variable to the studies of China's ODI. The studies by Armstrong (2011); Fan et al (2016); Maurao (2018); Jiang and Liu (2018) have chosen China's ODI as the output as they studied about the efficiency score of China's ODI. Moreover, due to a very limited studies on China's ODI efficiency, these four journals are the most relevant and comprehensive that can get access by the author (to the best extent of the author's knowledge).

2.4.2 China's GDP (Input)

China's GDP was chosen as one of the inputs by Armstrong (2011); Fan et al (2016); Jiang and Liu (2018). The reason to choose China's GDP is because it has significant impact on China's ODI no matter is positive or negative impact. According to the study by Fan et al (2016), there is a negative relationship between China's GDP and its ODI flows which the result did not support the expectation that larger country commonly would probably have higher outflow investment. In contrast, according to the study by Jiang and Liu (2018), China's GDP has significant positive influence to its ODI flows. The statement was supported by Yang, Wang, Wang, and Yeh (2017), which indicated that China's GDP has a significance positively correlation to its ODI flows, where the rise of China' economic development will lead to an increase in their ODI activities.

2.4.3 Host Country's GDP (Input)

Host country's GDP also an important input that used by Armstrong (2011); Fan et al (2016); Jiang and Liu (2018). The reason behind is that there is a positive linkage between host economy's GDP and China's ODI which is consistent with gravity model's prediction that host country will engage more FDI inflows if they have large market size (Fan et al, 2016). This statement further supported by Jiang and Liu (2018); Miniesy and Elish (2017); Sun and Shao (2017); Stack, Ravishankar, and Pentecost (2015). Chang (2014). Meanwhile, the study by Shan, Lin, Li, and Zeng (2018) was elaborated this positive relation is due to China's investor believed that there are greater investment opportunities in those host countries that having a relatively bigger market size. Besides that, the study by Liu, Tang, Chen, and Poznanska (2017) also shows that the market size of host country is significance to attract China's ODI even though they used real GDP instead of GDP as the proxy variable of the market size of host country.

2.4.4 Relative Geographical Distance (Input)

The study by Armstrong (2011); Fan et al (2016); Jiang and Liu (2018) have choose relative geographic distance as the input. This is because Armstrong (2011) and Fan, et al (2016), stated that relative geographical distance between China and host country was proven as negatively signed in China's ODI. Besides that, the statement is supported by Mele and Quarto (2017) which indicated that China's ODI flow was an inversely proportional to the distance between countries. Moreover, the study by Jiang and Liu (2018) indicated that the negative association between bilateral geographical distance and China's ODI proven that bilateral geographical distance between China and host country is an investment resistance.

2.4.5 GDP per capita (Input)

Fan et al (2016) and Maurao (2018) have chosen China's GDP per capita and host country's GDP per capita as one of the inputs. Fan et al (2016) stated that GDP per capita indicates the economic development level of China and host country, and economic development is positive impact on China's ODI flow. This statement supported by Mele and Quarto (2017), also indicated that host country's GDP per capital have a directly positive influence on the attraction of China's ODI.

2.4.6 Contiguous (Input)

Contiguous is a dummy variable that chosen by the of Fan et al (2016); Jiang and Liu (2018) as one of the inputs for China's ODI efficiency. The reason behind is that the dummy variable contiguous was significantly positive where implying that the shared border between home and host country can facilitate their FDI flows (Fan et al, 2016).

2.5 Empirical Evidence for Second-Stage Model

This subsection is to discuss the major empirical findings in the relevant past literature. Through the previous major literature findings, the present study could estimate the significance of the relationships and direction (positive or negative) between inefficiency determinants (investment resistances) and efficiency score of China's ODI (dependent variable, derived from first-stage analysis) in the study.

2.5.1 Inefficiency Determinants and China's ODI Efficiency

According to Armstrong (2011) and Mourao (2018), inefficiency determinants refer to the political factors and others relevant factors that will affect the efficiency score.

Besides, it was used to measure the inefficiency factors (human -made resistance) of ODI (Fan et al (2016); Jiang and Liu (2018)).

2.5.1.1 Language and China's ODI Efficiency

According to Armstrong (2011), language associated with higher efficiency score of China's ODI, this indicated that language similarity reduced the economic distance between China and host country. This statement is supported by Jiang and Liu (2018), language have a positive impact to China's ODI efficiency when host country shared a common language with China.

2.5.1.2 Voice and Accountability and China's ODI Efficiency

According to Armstrong (2011), voice and accountability was not significant or not impact to the China's ODI efficiency. This statement supported by Tong, Singh, Li (2018), their study's result also showed voice and accountability is not significant to China's ODI.

2.5.1.3 Political Stability and China's ODI Efficiency

According to Armstrong (2011), host country's political stability does not have an impact on the performance of China's ODI. This statement supported by Fan et al (2016) indicated that political stability showed a negative sign in their estimation result, but it is not significant. However, the study by Maurao (2018) indicated that higher political stability will increase the efficiency score of China's ODI.

2.5.1.4 Government Effectiveness and China's ODI Efficiency

According to Armstrong (2011), higher government effectiveness would be resulted on lower level efficiency of China's ODI. However, the study by Fan et al (2016) indicated that government effectiveness showed a positive sign in their estimation result, but it was not significant. Besides, the study by Jiang and Liu (2018), also showed the positive sign of host country's government effectiveness towards China's ODI, but it also not reached a significant level.

2.5.1.5 Regulation Quality and China's ODI Efficiency

According to Armstrong (2011), higher scores of regulation quality was associated with lower China's ODI efficiency. This statement supported by the study of Mourao (2018), regulation quality shows a negative coefficient towards China's ODI Efficiency, which indicated that lower regulation quality will increase the efficiency score of China's ODI.

2.5.1.6 Rule of Law and China's ODI Efficiency

According to Armstrong (2011), a positive relationship exists between rule of law and China's ODI efficiency. The stronger rule of law was expected would reduce the economic distance between host country and China, therefore, a higher efficiency score of China's ODI resulted (Armstrong, 2011). This is probably due to rule of law is highly significant and has positive influence on China's ODI (Tong, Singh, & Li, 2018). The study by Tong, Singh and Li (2018) stated that the higher rule of law index in the host country will attract more China's ODI as good legislation system promise the enforceability of the contract. Thus, investor will prefer to invest more as they felt them is protected.

2.5.1.7 Control of Corruption and China's ODI Efficiency

The study by Armstrong (2011) indicated that control of corruption was important to China's ODI efficiency, where stronger control of corruption would result in higher efficiency score of China's ODI. The statement can explain by Tong, Singh, and Li (2018) which control of corruption is positively significant to China's ODI due to the transparency strengthen then confident of investor. However, according to Maurao (2018), control of corruption showed a negative signed of coefficient towards China's ODI efficiency, but it is not significant.

2.6 Research Gap

Scholars have been enriching the existing literature of China's ODI since it experienced fast-paced development. However, the research on the performance of China's ODI is limited, where most of the studies focused on the motives, pattern, and impact. Therefore, the present study filled this gap by computing efficiency score of China's ODI that reflect its performance and potential and identify the inefficiency determinants that affect efficiency score.

Besides, in the aspect of computing efficiency score of ODI, the existing literature main uses firm-level dataset instead of the macro-level dataset. As a consequence, there is a gap towards the methodology framework to analyse the macro-level ODI efficiency. So that, to fill this gap, the present study using the macro-level dataset from ASEAN countries and employing stochastic frontier gravity model in this study. Stochastic frontier gravity model is believed will solve the shortcomings of conventional gravity model in previous literature.

Moreover, most studies focused on Africa and Europe region, but in fact, Asia is the largest regional China's ODI recipient. Meanwhile, inside those Asia's investigations, most scholars only selected few ASEAN member states as the observation instead of whole ASEAN. Hence, this study also filled the gap by whole

ASEAN which encompassed Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam as this study's observation.

2.7 Chapter Conclusion

This chapter reviewed the relevant previous literature and identified the literature's gaps. The first part of this chapter had discussed what is ODI efficiency. Next, discussed the background of conventional gravity model and the integration of stochastic frontier analysis in gravity model to form a stochastic frontier gravity model. Besides that, a discussion on previous empirical evidence provided. Lastly, this chapter ends with research gap and a chapter conclusion.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter discusses the methodology framework used in this study. Firstly, it provides the details of the research design, sources of the data, and definition of each variable. Next, this chapter continues by introducing the empirical model used, expected sign for each variable, the empirical testing procedure and ends with a chapter conclusion.

3.1 Research Design

This study focuses on the quantitative research to answer the research question and achieve the research objectives as well. The present study employs a stochastic frontier gravity model with a balanced panel dataset. The two-stage approach used in this study is adapted from Armstrong (2011) which the first-stage analysis will estimate an ODI frontier that helps to compute the efficiency score of China's ODI in ASEAN countries. The efficiency score reflects the performance and potential of China's ODI (defined as the actual amount of China's ODI relative to its frontier). Next, the second-stage analysis will use the efficiency scores that obtained in first-stage analysis to identify the inefficiency factors or called as investment resistances that will affect the efficiency scores of China's ODI in ASEAN countries by using Panel OLS method. In addition, the first-stage analysis will use *Frontier 4.1* software, while *Eviews 10* software will use for second-stage analysis.

3.2 Sources of Data

In this study, we were using secondary data to construct a balanced panel dataset from China and ten ASEAN countries, namely Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The panel dataset is from annual data basis, and its timeframe is over the period from the year 2005 until the year 2016, which total twelve years. This panel dataset accounted for a total of 120 observations in our study. The following shows the data sources for the variables used in this study.

Table 3.1: *Data Sources for First-Stage Analysis*

Variables	Sources
Dependent Variable	
China's ODI	*Statistical Bulletin of China's ODI*
Frontier Determinants	
China's GDP	WDI
Host Country's GDP	WDI
Bilateral Distance	CEPII
China's GDP per capita	WDI
Host Country's GDP per capita	WDI
Contiguous	CEPII
Legend	
WDI: World Development Indicators	
CEPII: Centre for International Prospective Studies and Information	

Table 3.2: *Date Sources for Second-Stage Analysis*

Variable	Sources
Dependent Variable	
Efficiency Scores of China's ODI	*Derived by author (from first-stage analysis)*
Inefficiency Determinants	
Language	CEPII
Voice and Accountability	WGI
Political Stability	WGI
Government Effectiveness	WGI
Regulation Quality	WGI
Rule of Law	WGI
Control of Corruption	WGI

Legend

CEPII: Centre for International Prospective Studies and Information

WGI: Worldwide Governance Indicators

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. 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.

3.3.1 Frontier determinants

Frontier determinants refer to the output and inputs that will be used to compute the efficiency scores of China's ODI. As mentioned in Chapter 2, when generating an output-oriented efficiency score needed a set of inputs with an output. Besides that, it is easier to differentiate the output and input in a stochastic frontier gravity model, where the dependent variable in the model is the output, while those independent variables are the inputs.

3.3.1.1 China's ODI

China's ODI as the dependent variable in our study and it refers to the outward FDI flow of China to each selected ASEAN country (Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam). Its indicator name in our study is $\boldsymbol{ODI_{ijt}}$ and it denominated in billion US dollars and retrieved from *the Statistical Bulletin of China's Outward Foreign Direct Investment* which is issued by Ministry of Commerce of China.

3.3.1.2 Gross Domestic Production (GDP)

In our study, both home and host country's GDP act as one of the input variables. The indicator name of home country's GDP is $\boldsymbol{GDP_{it}}$, while indicator name for host country's GDP is $\boldsymbol{GDP_{jt}}$. GDP is used to indicate the market size of home and host country. GDP is denominated in current US dollars that constant 2010.

3.3.1.3 Relative Geographic Distance

The indicator name of the relative geographic distance between home and host country is $\boldsymbol{RGD_{ijt}}$. It is one of the input variables and measured based on the bilateral distance between the biggest cities of home and host country. It is denominated in kilometre (km).

3.3.1.4 GDP per capita

GDP per capita is an input variable and it used to measure the level of economic development of home and host country. The indicator name of GDP per capita of the home country is $\boldsymbol{GDPPC_{it}}$, while host country refers to $\boldsymbol{GDPPC_{jt}}$. GDP per capita is denominated in current US dollars that constant 2010.

3.3.1.5 Relative Natural Resource Endowment

The relative natural resource endowment is proxied by the differences between logs of natural resource levels of China and host country. It is measured as the percentage ratio of total natural resource rents to GDP. The indicator name of relative natural resource endowment is $\boldsymbol{RNR_{ijt}}$.

3.3.1.6 Contiguous

$\boldsymbol{Contig_{ijt}}$ is the indicator name of contiguous and it also act as an input variable. It is a dummy variable that indicating whether home and host country are contiguous. This dummy variable will take the value of 1 if two countries are contiguous otherwise, take the value of 0.

3.3.2 Inefficiency Determinants

Inefficiency determinants that discuss as below are act as independent variables for second-stage analysis.

3.3.2.1 Language

$\boldsymbol{Lang_{ij}}$ is the indicator name of Language. It is a dummy variable and refers to the national language that in China country and host country. If take the value of 1 if China and host country share a common national language.

3.3.2.2 Voice and Accountability

$\boldsymbol{VA_{jt}}$ is the indicator name of voice and accountability of host country. Voice and Accountability captures the perceptions of the extent to which the citizens of a country that can participate in selecting the government, as well as freedom of the association and the expression, and a free media. It is ranging from -2.5 to 2.5.

3.3.2.3 Political Stability

$\boldsymbol{PS_{jt}}$ is the indicator name of political stability of host country. Political Stability measures the perceptions of the likelihood of the political instability and politically-motivated violence, including terrorism. It is ranging from -2.5 to 2.5.

3.3.2.4 Government Effectiveness

The indicator name of government effectiveness of host country is $\boldsymbol{GE_{jt}}$. Government Effectiveness captures the perceptions of the public services quality, the civil service quality, the quality of policy implementation and formulation, and the government's credibility. It is ranging from -2.5 to 2.5.

3.3.2.5 Regulation Quality

$\boldsymbol{RQ_{jt}}$ is the indicator name for host country's regulation quality. Regulatory Quality captures the perceptions of the government ability to formulate and implement the sound regulations and policies that permit and promote the development of private sector. It is ranging from -2.5 to 2.5.

3.3.2.6 Rule of Law

$\boldsymbol{ROL_{jt}}$ is the indicator name of rule of law of host country. Rule of Law captures the perceptions as to which agents have confidence in and abide by the society's rules, and in particular the quality of property rights, contract enforcement, the courts and the police, as well as the likelihood of violence and crime. It is ranging from -2.5 to 2.5.

3.3.2.7 Control of Corruption

$\boldsymbol{CC_{jt}}$ is the indicator name of the host country's control of corruption. Control of Corruption captures the perceptions to which public power is exercised for private benefits. It is ranging from approximately -2.5 to 2.5.

3.4 Empirical Model Specification

The two-stage approach actually is separated the stochastic frontier gravity model into two part. The first part of the model is follows Fan et al (2016) to compute the efficiency scores of China's ODI in ASEAN countries, while the second part of the model is follows Armstrong (2011) to identify the inefficiency factors (investment resistances) that affect the efficiency scores of China's ODI.

The First-Stage Model:

a) To compute the efficiency scores of China's ODI in ASEAN countries. The stochastic frontier gravity model is specified as below:

$$lnODI_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 RGD_{ijt} + \beta_4 lnGDPPC_{it} + \beta_5 lnGDPPC_{jt} + \beta_6 RNR_{ijt} + \beta_7 Contig_{ijt} + v_{ijt} - u_{ijt} \qquad (7)$$

Where,

$\boldsymbol{i}$, $\boldsymbol{j}$, and $\boldsymbol{t}$ represent the indexes of the home economy (China), host economy country (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam), and period (2005-2016) respectively.

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

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

$\boldsymbol{RGD_{ijt}}$ represents the relative geographic distance between China and ASEAN countries.

$\boldsymbol{GDPPC_{it}}$ and $\boldsymbol{GDPPC_{jt}}$ represent China's GDP per capita and each ASEAN country's GDP per capita respectively.

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

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

The Second-Stage Model:

b) To identify the inefficiency factors (investment resistances) that affect the efficiency scores of China's ODI in ASEAN countries. The inefficiency frontier model is specifies as below:

$$\exp(u_{ijt}) = \delta_0 + \delta_1 Lang_{ijt} + \delta_2 VA_{jt} + \delta_3 PS_{jt} + \delta_4 GE_{jt} + \delta_5 RQ_{jt} + \delta_6 ROL_{jt} + \delta_7 CC_{jt} + \varepsilon_{ijt} \quad \textbf{(8)}$$

Where,

$\boldsymbol{Lang_{ijt}}$ represents dummy variable, Language.

$\boldsymbol{VA_{jt}}$ represents Voice and Accountability of host country $\boldsymbol{j}$.

$\boldsymbol{PS_{jt}}$ represents Political Stability of host country $\boldsymbol{j}$.

$\boldsymbol{GE_{jt}}$ represents Government Effectiveness of host country $\boldsymbol{j}$.

$\boldsymbol{RQ_{jt}}$ represents Regulation Quality of host country $\boldsymbol{j}$.

$\boldsymbol{ROL_{jt}}$ represents Rule of Law of host country $\boldsymbol{j}$.

$\boldsymbol{CC_{jt}}$ represents Control of Corruption of host country $\boldsymbol{j}$.

$\boldsymbol{\varepsilon_{ijt}}$ represents error term.

Table 3.3: Expected Sign for Second-Stage Model

Variables	**Author**	**Expected Sign**
Language	Armstrong (2011); Jiang and Liu (2018)	Positive
Voice and Accountability	Armstrong (2011)	Negative
Political Stability	Fan et al (2016); Maurao (2018)	Negative
Government Effectiveness	Armstrong (2011); Maurao (2018)	Negative
Regulation Quality	Tong, Singh, and Li (2018)	Positive
Rule of Law	Armstrong (2011)	Positive
Control of Corruption	Maurao (2018)	Negative

3.5 Estimation Method

3.5.1 Stochastic Frontier Analysis

As mentioned in Chapter 2, the 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 focuses 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).

The present study 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).

3.5.2 Panel Data Regression Models

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 present study 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).

3.5.2.1 Pooled OLS Regression / Constant Coefficients Model

Pooled OLS model is pool all the observations and estimate a "grand" regression. It neglecting the time series and cross-section nature of the data. Indeed, Pooled OLS model pooled all the data together with no individual differences assumption. Pooled OLS model have few assumptions which written as follows:

a) It is assumed that all independent variables are non-stochastic.
b) It is assumed that the error term follows independent, identical distribution, $u_{it} \sim iid(0, \sigma_u^2)$.
c) It is assumed that independent variables strictly exogeneity.

3.5.2.2 Fixed Effect Least-Square Dummy Variable (LSDV) Model

The least square dummy variable (LSDV) model also known as the fixed effect model (FEM). It allows for heterogeneity among the subjects by allowing them to own an intercept value (dummy variable) independently. The "fixed effect" means that even though the intercept might differ across subjects, but each intercept is time invariant. Indeed, "fixed effect" is used to captures the heterogeneity of individual. Besides that, the differential intercept dummy technique is introduced to allows the intercept (fixed effect) vary among the subjects. Moreover, least-square dummy variable estimator is not feasible to use for a larger sample size when the number of dummy variable equal to sample size.

3.5.2.3 Fixed Effect Within-Group Model

The fixed effect within-group model is to eliminate the fixed effect in the pooled estimation through expressing the values of endogenous and exogenous variables as deviations from their means values. In other words, this model using the parameter of time-invariant and average the estimated observation across time. In fact, the resulting values are known as mean-corrected values or "de-meaned".

3.5.2.4 Random Effect Model

Random effect model (REM) also known as error components model (ECM). In this model, all the (common) intercept indicates the means value of all the (cross-sectional) intercepts. Besides that, its error component, ε_i is also known as unobservable or latent and represents the (random) deviation of individual intercepts from the mean value. The random effect estimator is best linear unbiased estimator (BLUE) when all regressors are strict exogeneity.

3.5.3 Model Comparison Test

Three are three testing will be conducting to find out which model is preferred among POLS, FEM, and REM.

3.5.3.1 Poolability F-Test (POLS vs FEM)

Poolability F-Test also refers to likelihood ratio test which used to find out whether POLS is preferred or FEM is preferred. In other words, this testing examines that whether the model suffer from individual effect. Null and alternative hypothesis are written as below:

Null Hypothesis	H_0: $\mu_i = 0$ (POLS is preferred)
Alternative Hypothesis	H_1: $\mu_i \neq 0$ (FEM is preferred)

μ_i represent the individual effect, so that if null hypothesis be rejected, then indicates that model suffer from individual effect which FEM is preferred.

Otherwise, POLS is preferred when individual effect equal to zero, implies that POLS satisfy all the underlying assumption that able to acts as a best estimator.

3.5.3.2 Breusch-Pagan Lagrange Multiplier Test (POLS vs REM)

The BP-LM test is examine whether random effect exist in the model. POLS is preferred when the homogeneous condition, while REM is preferred when the heteroskedasticity occurs. The null and alternative hypothesis shows as below:

Null Hypothesis H$_0$: $\sigma_u^2 = 0$ (POLS is preferred)
Alternative Hypothesis H$_1$: $\sigma_u^2 \neq 0$ (REM is preferred)

3.5.3.3 Hausman Test (FEM vs REM)

Hausman test is used to test whether FEM or REM is preferred, this test will only be conducted if the Poolability F-test and BP-LM test indicates that FEM and REM are preferred respectively. REM is preferred if there is no correlation between the exogenous variables and individual effect. Otherwise, FEM is preferred because its individual effect is constant even though correlation problem exists. The null and alternative hypothesis are written as below:

Null Hypothesis H$_0$: $cov(\mu_{it} \ / \ X_{it} = 0$ (REM is preferred)
Alternative Hypothesis H$_1$: $cov(\mu_{it} \ / \ X_{it} \neq 0$ (FEM is preferred)

3.6 Chapter Conclusion

This chapter first discussed the research design of the present study. Next, this chapter provided the data sources and data description for frontier determinants and inefficiency determinants. An empirical model was specified in this chapter, then follow by the discussion on estimation method which included stochastic frontier analysis that used for first-stage model and the panel data models (POLS, FEM, and REM) that used in second-stage analysis. As three panel model are used, therefore this chapter discussed the model comparison tests (Poolability F-Test, BP-LM Test, and Hausman Test) thus all the empirical results regarding the present study will interpret in next chapter. Last, this chapter ends with a chapter conclusion.

CHAPTER 4: RESULTS INTERPRETATION

4.0 Introduction

As a continuation of Chapter 3, this chapter will discuss and interpret the empirical results from the model that specified in previous chapter. In general, this chapter will separate into two parts to answer and achieve the two research questions and objectives that mentioned in Chapter 1. Firstly, the interpretation of the efficiency scores of China's ODI in each ASEAN countries over the period 2005 to 2016 to indicate the performance and potential of China's ODI in ASEAN countries. Secondly, discuss the empirical findings that resulted from second-stage analysis to identify which inefficiency determinants that will affect the efficiency scores of China's ODI in ASEAN countries. Lastly, this chapter will end with a chapter conclusion.

4.1 Efficiency Scores of China's ODI

The efficiency score of China's ODI is defined as the ratio of actual ODI to potential ODI. It reflects the performance and potential of China's ODI in each ASEAN country. The efficiency scores range between 0 to 1, which value 1 is indicates that the actual ODI flow lies on the ODI frontier (full potential has reached). According to Armstrong (2011), the higher efficiency score indicated the higher performance of ODI, which is less affected by the inefficiency factors. Meanwhile, the lower room of potential will be resulted in higher performance of ODI (as it nearly full potential). Therefore, according to Fan et al (2016), a higher ODI performance means the lower potential level of ODI in future (the lower room to improve).

The efficiency scores of China's ODI in ASEAN countries over the period 2005 to 2016 is shown in Table 3. Moreover, the benchmarks for efficiency scores by Gulati (2011) is provided as below:

***Table 4.1**: Benchmark of Efficiency Score*

Efficiency Score	Efficiency level	Rank
E < 0.5	Inefficiency	7
0.5 ≤ E < 0.6	Low efficiency	6
0.6 ≤ E < 0.7	Semi Low efficiency	5
0.7 ≤ E <0.8	Medium efficiency	4
0.8 ≤ E <0.9	Semi High Efficiency	3
0.9 ≤ E < 1	High Efficiency	2
E = 1	Full efficient	1

***Source:** Gulati (2011)*

Mean Efficiency = 0.3494 indicates that the overall efficiency scores of China's ODI in ASEAN countries over the period 2005-2016. The result shows that the overall performance of China's ODI in ASEAN countries falls under the rank 7 (0.3494 < 0.5) which is inefficiency level. Even though, the overall performance of China's ODI is inefficient but on the other hands, this shows the higher potential of China's ODI in ASEAN countries, where there is a big room to improve or gain more return in future.

$Mean_a$ indicates the efficiency scores (performance) of China's ODI in ASEAN countries by yearly. Based on the results, the range of the yearly efficiency scores of China's ODI in ASEAN countries (2005-2016) is between 0.3059 to 0.4075. The lowest performance of China's ODI in ASEAN countries fall in 2006 ($Mean_a$ = 0.3059), while the highest performance of China's ODI in ASEAN countries fall in 2016 ($Mean_a$ = 0.4076). Both efficiency scores are less than 0.5, achieved at inefficiency level (rank 7).

$Mean_b$ indicates the efficiency scores (performance) of China's ODI by country. Based on the results, the range of the efficiency scores of China's ODI in a particular

ASEAN country from 2005 to 2016 is between 0.2270 to 0.5371. The lowest China's ODI performance of ASEAN country is Myanmar ($Mean_b$ = 0.2270) which under the category of inefficiency level (rank 7), while the highest China's ODI performance of ASEAN country is Malaysia ($Mean_b$ = 0.5371) which achieved at low efficiency level (rank 6).

Minimum efficiency scores (Min) indicate the lowest efficiency scores (lowest performance) of China's ODI in a particular ASEAN country from 2005 to 2016. Based on the results, the range of this category is 0.0000 to 0.2332 which lesser than 0.5, so that it was achieved at inefficiency level (rank 7). The countries that have lowest efficiency score countries are Singapore (2005), Brunei (2006, 2012, 2014), Philippines (2007-2009, 2013, 2015-2016), Indonesia (2010), Myanmar (2011). In short, Philippines and Brunei are the countries that repeated to become destination of lowest China's ODI efficiency score compared to other ASEAN countries

Maximum efficiency scores (Max) indicate the highest efficiency scores (highest performance) of China's ODI in a particular ASEAN country from 2005 to 2016. Based on the results, the range of this category is 0.4637 to 0.7817, which from rank 7 (Inefficiency level) to 4 (Medium Efficiency level). The countries that have the highest efficiency score are Malaysia (2005, 2013-2016), Vietnam (2006), Thailand (2007, 2010, 2012), Singapore (2008), Brunei (2009, 2011). In short, Malaysia and Thailand are the countries that repeated to become the destination of highest efficiency scores of China's ODI, and achieved at Medium Efficiency level and Semi Low-Efficiency level respectively.

***Table 4.2**: Efficiency Scores of China's ODI in ASEAN Countries, 2005-2016*

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Mean$_b$
Brunei	0.6948	0.0000	0.3506	0.2864	0.4637	0.5214	0.4946	0.0596	0.2682	0.1198	0.1421	0.6912	0.3410
Cambodia	0.1609	0.1396	0.3034	0.4125	0.4069	0.4084	0.3672	0.3379	0.2845	0.2948	0.3328	0.4093	0.3215
Indonesia	0.2634	0.3801	0.2990	0.2656	0.2506	0.1322	0.2163	0.3221	0.3052	0.2392	0.2741	0.2479	0.2663
Lao PDR	0.4043	0.4661	0.5052	0.2709	0.4206	0.3913	0.3793	0.4739	0.4467	0.4995	0.4295	0.3275	0.4179
Malaysia	0.7817	0.4541	0.5383	0.4139	0.4522	0.5138	0.3264	0.4564	0.6095	0.5810	0.5924	0.7252	0.5371
Myanmar	0.2152	0.1255	0.2744	0.3030	0.3711	0.3728	0.1052	0.2691	0.1808	0.1543	0.1883	0.1648	0.2270
Philippines	0.2672	0.2852	0.1052	0.2108	0.2332	0.4587	0.4094	0.1521	0.0974	0.3223	0.0744	0.0704	0.2238
Singapore	0.1374	0.2841	0.3263	0.4706	0.4360	0.2382	0.3526	0.1887	0.2032	0.2888	0.5689	0.3593	0.3212
Thailand	0.3832	0.4504	0.5527	0.3449	0.3118	0.6377	0.3904	0.5167	0.5593	0.5701	0.4600	0.6106	0.4823
Vietnam	0.5017	0.4735	0.4678	0.3601	0.2802	0.3570	0.2084	0.2869	0.3096	0.2273	0.3243	0.4684	0.3554
Mean$_a$	0.3810	0.3059	0.3723	0.3339	0.3626	0.4031	0.3250	0.3064	0.3265	0.3297	0.3387	0.4075	
Min	0.1374	0.0000	0.1052	0.2108	0.2332	0.1322	0.1052	0.0596	0.0974	0.1198	0.0744	0.0704	
Max	0.7817	0.4735	0.5527	0.4706	0.4637	0.6377	0.4946	0.5167	0.6095	0.5810	0.5924	0.7252	
Mean Efficiency	0.3494												

Source: *Computed by Author that using Frontier 4.1 software*

4.2 Model Comparison (Second-Stage Analysis)

As mentioned in previous chapter, there are three models (POLS, FEM, REM) can be used to examine a panel data at second-stage analysis. However, which model is the best for the present study should be answer before discuss and interpret the empirical results. The present study had performed a set of comparison test (Likelihood Ratio Test, Lagrange Multiplier Test, and Hausman Test) for choosing whether POLS, FEM, or REM is preferred.

Based on the rule of thumb, the comparison testing between the models have to follow the sequence, which the first testing is Likelihood ratio test (POLS vs FEM), then follows by Lagrange Multiplier test (POLS vs REM), and Hausman test (FEM vs REM). If the result of Likelihood Ratio Test shows the null hypothesis did not be rejected, which indicated that POLS is preferred, then no need to continue with Lagrange Multiplier test and Hausman test.

Based on the result of Likelihood ratio test, $p-value = 0.6836$ large than $\alpha = 0.05$. Therefore, POLS is preferred because $p-value > \alpha\ value$, cannot reject the null hypothesis. POLS model is most appropriate in the present study might due to the inclusion of time dummy variable or time trend does not significantly change the estimation result (Armstrong, 2011). The full result of comparison testing has shown in Appendix E.

4.3 Results Interpretation (Second-Stage Analysis)

Based on the POLS estimation result (as shown in Table 4.3), the expression of POLS model as written as below:

$$\text{EODI} = 0.2280 + 0.1126Lang_{ijt} - 0.1207VA_{jt} - 0.0335PS_{jt} - 0.0513GE_{jt} \\ +0.1102RQ_{jt} + 0.3430ROL_{jt} - 0.3016CC_{jt} + \varepsilon_{ijt}$$

The result in Table 4.3 shows that R^2 is 0.3305 which indicated the goodness of fit of the estimated model. Besides that, Language ($\boldsymbol{Lang_{ijt}}$), Voice and Accountability ($\boldsymbol{VA_{jt}}$), Regulation Quality ($\boldsymbol{RQ_{jt}}$), Rule of Law ($\boldsymbol{ROL_{jt}}$), and Control of Corruption ($\boldsymbol{CC_{jt}}$) are statistically significant except for Political Stability ($\boldsymbol{PS_{jt}}$) and Government Effectiveness ($\boldsymbol{GE_{jt}}$).

As Political Stability ($\boldsymbol{PS_{jt}}$) and Government Effectiveness ($\boldsymbol{GE_{jt}}$) are statistically insignificant in the estimation, therefore these two variables are assumed to be not related to the efficiency scores of China's ODI in ASEAN countries. This result is in line with the study by Jiang and Liu (2018) and Tong, Singh, Li (2018).

Language ($\boldsymbol{Lang_{ijt}}$) is statistically significant at 5 percent level and has a positive slope coefficient (0.1126). The positive coefficient indicates that host country that having a common language with China will leads 0.1126 unit increase in efficiency score of China's ODI. This shows that host country and China have common language will improve the performance of China's ODI. This result is supported by Armstrong (2011) who stated that language similarity will reduce the economic distance between ODI source and host countries then leads to an attraction of ODI.

Voice and Accountability ($\boldsymbol{VA_{jt}}$) has a negative coefficient value (-0.1207) and statistically significant at 1 percent level. The negative coefficient means that an increase by 1 unit of the score of voice and accountability will cause the efficiency score of China's ODI decrease by 0.1207. This result indicates that higher score for voice and accountability in host country is associated with lower performance of China's ODI. This result probably due to higher score of voice and accountability cause a democracy constraint over the government of host countries and weaken the freedom of multinational corporations in host countries thus diminishing on their outflow investment (Berden, Bergstrand & van Etten, 2012); (Li & Resnick, 2003).

Regulation Quality ($\boldsymbol{RQ_{jt}}$) is statistically significant at 5 percent level and shows a positive coefficient value (0.1102). The result indicates that an increase by 1 unit of the score of regulation quality will leads to 0.1102 increase in efficiency score of

China's ODI. In other words, higher scores of regulation quality bring positive impact on the performance of China's ODI. The reason behind is that China investor emphasis on the enforceability and quality of host country's regulation when they determine the investment location (Tong, Singh, & Li, 2018).

Rule of Law ($\boldsymbol{ROL_{jt}}$) has a positive coefficient value (0.3430) and statistically significant at 1 percent level. This result shows that an increase in the score of rule of law by 1 unit will increase efficiency score of China's ODI by 0.3430. This is because stronger rule of law indicated a strong institution that reduce the economic distance between home and host countries (Armstrong, 2011). In other words, stronger rule of law promises the quality of legal system and good legislation of host countries thus positively influence the China's ODI (Tong, Singh, & Li, 2018).

Control of Corruption ($\boldsymbol{CC_{jt}}$) is statistically significant at 1 percent level and has a negative coefficient value (-0.3016). This result indicates that the score of control of corruption increased by 1 unit will negatively impact on the efficiency score of China's ODI decrease by 0.3016. The reason behind is that multinational enterprises (MNEs) might use bribes to circumvent regulations that burdensome and obstacles of bureaucratic at a relatively less cost under certain circumstances (Brada, Drabek, & Perez, 2012). Meanwhile, the study by Brada, Drabek, and Perez (2012) also stated that multinational enterprises (MNEs) from a corrupt country will not prefer that much invest in the country that has lower corruption. According to Transparency International (2017), the ranking of corruption perception index 2016 of China (ranked 79) lower than Singapore (ranked 7), Brunei (ranked 41), and Malaysia (ranked 55), which shows the higher level of corruption of China compared to the other four countries, the ranking result probably support the statement by Brada, Drabek, and Perez (2012).

***Table 4.3**: POLS Model Estimation Result*

Variable	Coefficient	t-value	p-value
Constant (δ_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 Effectiveness (GE_{jt})	-0.0513 (0.07723)	-0.6641	0.5080
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

Notes: ***, **, *, shows rejection of null hypothesis at 1%, 5%, 10% level of significant. The parenthesis refers to standard error

4.4 Chapter Conclusion

This chapter first discussed the result of efficiency scores of China's ODI in ASEAN countries over the period from 2005 to 2016 by using the benchmark by Gulati (2011). Secondly, discussed the result of model comparison then chosen POLS as the most appropriate model. Lastly, the interpretation of the results regarding inefficiency determinants and end with a chapter conclusion.

CHAPTER 5: CONCLUSION

5.0 Introduction

As a last chapter for the present study, this chapter will first summarise all the related findings. Secondly, discuss the implication of the study by suggesting relevant policy implications that based on the findings. Next, the determination of the limitation of the present study and make recommendations for the future study purpose. Lastly, this chapter will end with a final conclusion.

5.1 Summary of Findings

The present study aims to compute the efficiency scores of China's ODI in ASEAN countries over the period 2005-2016 and to identify the inefficiency factors that affect the efficiency scores of China's ODI. The present study had employed a stochastic frontier gravity model and adopted the two-stage approach by Armstrong (2011) to answer and achieve the research questions and objectives. 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 contiguous (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 countries in future because it has not achieved at frontier level yet.

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.

Based on the result, 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.

At the same time, 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.

5.2 Implications of The Study

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.

Common language shared by China and ASEAN countries is proven will have a positive impact on the efficiency scores. Among the ASEAN countries, Malaysia and Singapore are the only two countries that shared the common languages (Mandarin) with China. As China rise as the second largest economies and it stronger global influence, there is a desire for ASEAN countries to take initiative to promote Mandarin language to their population. However, in realistic it is hard to promote a language that different from the first language or native language in respective countries unless the people willing to learn or self-interested. Even though some countries might take initiatives to introduce and promote the language (Example: Mandarin) but it is a long journey for them (as official language defined as at least 20 percent of the population that used the language for their daily lifestyle).

Despite of promote a strange language will face the difficulties, but undoubtedly an effective way for the respective government to promote the language is through the education system. For instance, the education system of Singapore initially focuses only English (Singlish) but it added the Mandarin teaching after the government realise on the important of Mandarin language. Therefore, the education policy works well for introduce a strange language to the population even though it takes a longer time.

In fact, China and ASEAN countries might not only can depends on the Mandarin language as the common language shared by them. The reason behind is that if Mandarin language project is a big project, then English language project will relatively small to them. According to Kirkpatrick (2012), the working language of ASEAN countries mostly is English. Meanwhile, China also promote English subject in their education system. Therefore, while ASEAN countries promote Mandarin language in respective countries, English is relatively high potential to be another official language for China. If the situation happens, China and ASEAN countries can share English as common language. In other words, China and ASEAN countries share a common language is not only a hope, maybe it not happened immediately but it might happen in future through both sides promote English and Mandarin effectively through their education system.

Next, 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 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.

There are two general ways that able to improve the ability of government, first is reduce and resize the government's departments, procedure, and employees, second is select the right person at right position. Diminishing marginal productivity situation not only will happen in firm but also might happen in the government. ASEAN countries should always re-examine the key performance indicator (KPI) of all the government's employees and penalty or dismiss the employee who has a lower KPI or unsatisfactory performance. Some of the ASEAN countries might facing redundant government and procedure, so that they are necessary to remove or revise those unnecessary department and procedure to work effectively. While for select right person at right position is means that those position that required specific skill or talent have to choose or select the expert or relevant person to hold the position instead of be cronyism.

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 ODI comes in.

5.3 Limitations of The Study

Nothing is perfect in the world, each of the research or studies has their limitations. Based on the present study, this chapter has identified few limitations that can improve for the future research. Firstly, the use of aggregate FDI flow data would be a limitation of the study. The reason behind is that FDI flow is vulnerable to the single events, so might cause the irregularities disturbing on the gravity law (Fan et al., 2016). Besides, the used of aggregate FDI data is not allows for a more precise or in-depth analysis compared to the sectoral-level FDI data that able to give more insights regarding the pattern and preferences of industrial FDI.

Secondly, the limitation of the availability of the China's ODI data in ASEAN countries. The official China's ODI data is record and publish in the annual statistical bulletin by the Department of Outward Investment and Economic Cooperation under Ministry of Commerce of the People's Republic of China since 2003. However, the official data of China's ODI in ASEAN countries was only limited from 2005 to 2016, which total 12 years. This cause the sample size of the present study relatively smaller.

Thirdly, the ignore of third country effect in empirical model would also a limitation of the study. The present study did not include multilateral interaction variables to capture the third country effect for the present study which might distort this bilateral analysis or produce the undesirable result. The reason behind is that the investment decision that made by multinational enterprises (MNEs) is not only depends on the characteristics of home and host country, but also rely on third country's characteristics (Armstrong, 2011).

Lastly, the limitation of the two-stage approach that adopted for the present study. Even though the non-negative error term (derived from stochastic frontier analysis – first-stage analysis) is able to use for the second-stage analysis (panel model analysis) as the dependent variable, but the results might not that desirable. This probably due to the contradict assumption of inefficiency effect between first-stage analysis and second-stage analysis. According to Battese and Coelli (1995), the inefficiency effect is assumed to be independently and identically distributed at first-stage analysis but not at the second-stage analysis (it as a function of the specific factor for regression model). As a consequence, lower R^2 was resulted in the regression model and it reflect the difficulty to measure the significant of those inefficiency factors (Armstrong, 2011).

5.4 Recommendation for Future Studies

The present study would like to shed the light for future researcher that interested in the relevant research topic that similar to the present study. Firstly, this study would like to suggest future researcher using disaggregate FDI data such as sectoral FDI data instead of using aggregate FDI for the similar study. The sectoral FDI data is believe will provide more insights that enable the future research to conduct the in-depth analysis on industrial distribution of China’s ODI, behaviour of sectoral investment of China across countries.

Secondly, the limitation of sample size can solve by using sectoral FDI data. Besides that, the vulnerability of FDI flow data which causing the misleading result can solve through inclusion of FDI stock data as a comparison.

Thirdly, the future research is suggested to include the multilateral factors that capture the third-country effect. This inclusion is believed will make the estimation more precise and accurate.

Lastly, for the part of methodology, one-step approach by Battese and Coelli (1995) is suggested for the future studies that which to determine the efficiency scores and inefficiency factors. The one-step approach is able to do the estimation simultaneously and produce desirable result.

5.5 Conclusion

In a nutshell, the present study has answered and achieved the given research questions and research objectives. This study found out that the performance of China’s ODI remains lower in ASEAN countries which reflected by the lower efficiency scores. However, this result also indicated that China’s ODI has a higher potential level in ASEAN countries, which the room to improve or enhance is bigger. This urge the China’s government can make more ODI allocation in the ASEAN countries thus solve the inequal ODI distribution problem that mentioned earlier. Besides that, the present study also found out language, regulation quality, and rule of law can positively influence the efficiency score of China's ODI which is a highlight from the study. This result able to provide the insight to China's government and ASEAN countries regarding the factors that consider by China's government when making ODI decision to ASEAN countries. Last but not least, the present study shed the light on the efficiency analysis and provides the framework that as the reference for the future researcher who study a similar research topic.

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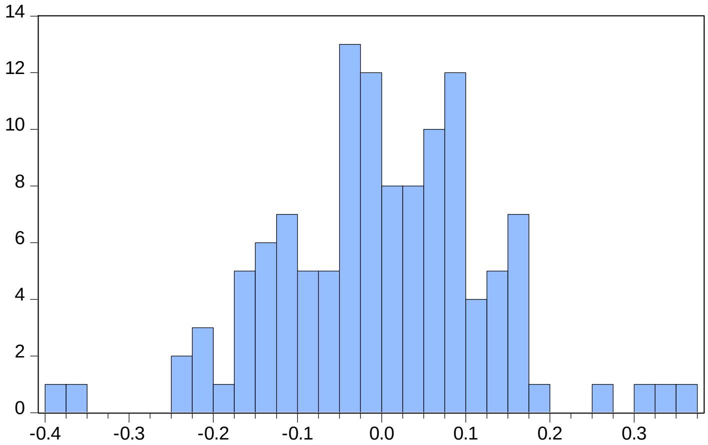
Appendices

Appendix A: Normality Test



Series: Standardized Residuals
Sample 2005 2016
Observations 120

Mean	-2.39e-17
Median	-0.000381
Maximum	0.363927
Minimum	-0.390140
Std. Dev.	0.126380
Skewness	-0.082222
Kurtosis	3.821040
Jarque-Bera	3.505742
Probability	0.173276

Appendix B: Pooled OLS Model

Dependent Variable: EODI
Method: Panel Least Squares
Date: 07/31/18 Time: 01:33
Sample: 2005 2016
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.228029	0.045043	5.062497	0.0000
LANG	0.112561	0.048898	2.301948	0.0232
VA	-0.120729	0.037291	-3.237474	0.0016
PS	-0.033473	0.026527	-1.261819	0.2096
GE	-0.051283	0.077226	-0.664066	0.5080
RQ	0.110232	0.055681	1.979719	0.0502
ROL	0.343025	0.112256	3.055743	0.0028
CC	-0.301630	0.055655	-5.419660	0.0000

R-squared	0.330468	Mean dependent var	0.349363
Adjusted R-squared	0.288622	S.D. dependent var	0.154451
S.E. of regression	0.130269	Akaike info criterion	-1.174088
Sum squared resid	1.900645	Schwarz criterion	-0.988255
Log likelihood	78.44529	Hannan-Quinn criter.	-1.098621
F-statistic	7.897275	Durbin-Watson stat	1.648840
Prob(F-statistic)	0.000000		

Appendix C: Fixed Effect Model

Dependent Variable: EODI
Method: Panel Least Squares
Date: 07/31/18 Time: 01:40
Sample: 2005 2016
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.214408	0.048937	4.381276	0.0000
LANG	0.111458	0.049998	2.229221	0.0280
VA	-0.127182	0.039200	-3.244412	0.0016
PS	-0.034371	0.027458	-1.251774	0.2135
GE	-0.026234	0.084359	-0.310981	0.7565
RQ	0.112216	0.056880	1.972841	0.0512
ROL	0.313081	0.119283	2.624699	0.0100
CC	-0.299540	0.057416	-5.217051	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.375363	Mean dependent var	0.349363
Adjusted R-squared	0.264042	S.D. dependent var	0.154451
S.E. of regression	0.132501	Akaike info criterion	-1.060165
Sum squared resid	1.773196	Schwarz criterion	-0.618812
Log likelihood	82.60987	Hannan-Quinn criter.	-0.880929
F-statistic	3.371891	Durbin-Watson stat	1.587006
Prob(F-statistic)	0.000052		

Appendix D: Random Effect Model

Dependent Variable: EODI
Method: Panel EGLS (Period random effects)
Date: 07/31/18 Time: 01:41
Sample: 2005 2016
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.226370	0.046467	4.871677	0.0000
LANG	0.112441	0.049772	2.259146	0.0258
VA	-0.121495	0.038088	-3.189861	0.0018
PS	-0.033548	0.027044	-1.240466	0.2174
GE	-0.048223	0.079275	-0.608300	0.5442
RQ	0.110511	0.056669	1.950126	0.0537
ROL	0.339280	0.114828	2.954674	0.0038
CC	-0.301366	0.056720	-5.313218	0.0000

Effects Specification

	S.D.	Rho
Period random	0.017104	0.0164
Idiosyncratic random	0.132501	0.9836

Weighted Statistics

R-squared	0.332233	Mean dependent var	0.323454
Adjusted R-squared	0.290498	S.D. dependent var	0.153923
S.E. of regression	0.129652	Sum squared resid	1.882688
F-statistic	7.960451	Durbin-Watson stat	1.640682
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.330455	Mean dependent var	0.349363
Sum squared resid	1.900680	Durbin-Watson stat	1.650263

Appendix E: Likelihood Ratio Test (POLS vs FEM)

Redundant Fixed Effects Tests
Equation: Untitled
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	0.659945	(11,101)	0.7728
Period Chi-square	8.329155	11	0.6836

Period fixed effects test equation:
Dependent Variable: EODI
Method: Panel Least Squares
Date: 07/31/18 Time: 01:41
Sample: 2005 2016
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.228029	0.045043	5.062497	0.0000
LANG	0.112561	0.048898	2.301948	0.0232
VA	-0.120729	0.037291	-3.237474	0.0016
PS	-0.033473	0.026527	-1.261819	0.2096
GE	-0.051283	0.077226	-0.664066	0.5080
RQ	0.110232	0.055681	1.979719	0.0502
ROL	0.343025	0.112256	3.055743	0.0028
CC	-0.301630	0.055655	-5.419660	0.0000

R-squared	0.330468	Mean dependent var	0.349363
Adjusted R-squared	0.288622	S.D. dependent var	0.154451
S.E. of regression	0.130269	Akaike info criterion	-1.174088
Sum squared resid	1.900645	Schwarz criterion	-0.988255
Log likelihood	78.44529	Hannan-Quinn criter.	-1.098621
F-statistic	7.897275	Durbin-Watson stat	1.648840
Prob(F-statistic)	0.000000		

Appendix F: Lagrange Multiplier Test (POLS vs REM)

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	0.119205 (0.7299)	0.769733 (0.3803)	0.888938 (0.3458)
Honda	0.345261 (0.3649)	-0.877344 (0.8099)	-0.376240 (0.6466)
King-Wu	0.345261 (0.3649)	-0.877344 (0.8099)	-0.332488 (0.6302)
Standardized Honda	2.761256 (0.0029)	-0.776318 (0.7812)	-3.481416 (0.9998)
Standardized King-Wu	2.761256 (0.0029)	-0.776318 (0.7812)	-3.438447 (0.9997)
Gourieroux, et al.*	--	--	0.119205 (0.6005)

Appendix G: Hausman Test (FEM vs REM)

Correlated Random Effects - Hausman Test
Equation: Untitled
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	0.000000	7	1.0000

* Period test variance is invalid. Hausman statistic set to zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LANG	0.111458	0.112441	0.000023	0.8363
VA	-0.127182	-0.121495	0.000086	0.5397
PS	-0.034371	-0.033548	0.000023	0.8623
GE	-0.026234	-0.048223	0.000832	0.4458
RQ	0.112216	0.110511	0.000024	0.7280
ROL	0.313081	0.339280	0.001043	0.4172
CC	-0.299540	-0.301366	0.000079	0.8376

Period random effects test equation:
Dependent Variable: EODI
Method: Panel Least Squares
Date: 07/31/18 Time: 01:43
Sample: 2005 2016
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.214408	0.048937	4.381276	0.0000
LANG	0.111458	0.049998	2.229221	0.0280
VA	-0.127182	0.039200	-3.244412	0.0016
PS	-0.034371	0.027458	-1.251774	0.2135
GE	-0.026234	0.084359	-0.310981	0.7565
RQ	0.112216	0.056880	1.972841	0.0512
ROL	0.313081	0.119283	2.624699	0.0100
CC	-0.299540	0.057416	-5.217051	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.375363	Mean dependent var	0.349363
Adjusted R-squared	0.264042	S.D. dependent var	0.154451
S.E. of regression	0.132501	Akaike info criterion	-1.060165
Sum squared resid	1.773196	Schwarz criterion	-0.618812
Log likelihood	82.60987	Hannan-Quinn criter.	-0.880929
F-statistic	3.371891	Durbin-Watson stat	1.587006
Prob(F-statistic)	0.000052		

Appendix H: ROBUST LEAST SQUARE

Dependent Variable: EODI
Method: Robust Least Squares
Date: 07/31/18 Time: 01:43
Sample: 2005 2016
Included observations: 120
Method: M-estimation
M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered)
Huber Type I Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.230598	0.043845	5.259382	0.0000
LANG	0.109558	0.047598	2.301736	0.0214
VA	-0.131686	0.036299	-3.627760	0.0003
PS	-0.040967	0.025822	-1.586539	0.1126
GE	-0.090610	0.075172	-1.205371	0.2281
RQ	0.137923	0.054200	2.544718	0.0109
ROL	0.378832	0.109271	3.466905	0.0005
CC	-0.312424	0.054175	-5.766963	0.0000

Robust Statistics

R-squared	0.316215	Adjusted R-squared	0.273479
Rw-squared	0.417785	Adjust Rw-squared	0.417785
Akaike info criterion	123.7505	Schwarz criterion	149.7170
Deviance	1.562251	Scale	0.118413
Rn-squared statistic	61.40544	Prob(Rn-squared stat.)	0.000000

Non-robust Statistics

Mean dependent var	0.349363	S.D. dependent var	0.154451
S.E. of regression	0.130585	Sum squared resid	1.909870