The determinants of China’s ODI to Southeast Asian countries: further evidence from count data model

Mengjiao Wang\textsuperscript{2,3}, Jianxu Liu\textsuperscript{1,2} and Songsak Sriboonchitta\textsuperscript{1,2}

\textsuperscript{1}Puey Ungphakorn Center of Excellence in Econometrics, Faculty of Economics, Chiang Mai University, Chiang Mai 50200, Thailand
\textsuperscript{2}Faculty of Economics, Chiang Mai University, Chiang Mai 50200, Thailand
\textsuperscript{3}Email: 15969526351@163.com

Abstract. This paper investigates the main determinants of China’s Outward Direct Investment activities in 11 Southeast Asian countries by using the count data models. Several hypotheses are developed according to literature survey and empirically tested using the count data of the number of China’s ODI enterprises in Southeast Asian countries from 2003 to 2015. The results show that China’s ODI is determined by the market characteristics of host countries. Chinese investment enterprises are attracted to countries with great market potential, high openness degree and complete infrastructures whereas the natural resources availability and labour cost of host countries have significant negative impact on China’s ODI. Except for the characteristics of host countries, Chinese investment enterprises also attach importance to the surrounding market potential of host countries. Moreover, China’s ODI and export to Southeast Asian countries are considered to be substitute to each other.

1. Introduction
With increasing cooperation between China and Southeast Asian countries, China’s Outward Direct Investment (ODI) to Southeast Asian countries have achieved sustained and rapid growth. The net outflows of China’s ODI into ASEAN reached 14.6 billion dollars in 2015, increased by 87% compared with last year. However, the share of China’s ODI into ASEAN remained relatively small at 6.8 percent of total net inflows to this region in 2015 which implies there is still considerable scope for collaboration between China and Southeast Asian countries.

It is of great significance for both China and Southeast Asian countries to promote investment cooperation. Cooperation between China and Southeast Asian countries is closely related to the construction of the “Belt and Road” Initiative. As a result, the promotion of China’s ODI to Southeast Asian countries not only conforms to Chinese enterprises’ strong wish to be internationalized but also fits in with China’s strategies. Moreover, the “Belt and Road” Initiative emphasizes to share development opportunities with countries along the routes and achieve common prosperity and this means Southeast Asian countries can also benefit from Chinese investment.

Given the importance of cooperation, a clear understanding of the main determinants of China’s ODI is the first step to promote Chinese investment in Southeast Asia countries. The phenomenal growth of China’s ODI is now attracting increasing attention of scholars, but most of the related studies are based on the data of Foreign Direct Investment (FDI) flow or stock that are often available while only a small number of studies concern about the number of FDI enterprises established in host countries.
In this paper, the determinants of Chinese ODI are investigated by using the data set of public listed Chinese ODI enterprises in 11 Southeast Asian countries: Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam and East Timor, covering the period from 2003 to 2015. By utilizing count data of the number of Chinese investment enterprises, tax havens problem that has plagued other studies can be avoided. Tax havens reflect a phenomenon of “round-tripping”, whereby funds are moved abroad to take advantage of beneficial host country conditions and then are re-invested in China to benefit from advantageous terms for foreign investors (Kolstad and Wiig, 2009) [1]. Thereby further evidence about the determinants of Chinese ODI will be provided from different perspective based on count data other than the continuous data of FDI stock or inflow.

2. Theoretical background, literature review and hypothesis development

2.1. Theoretical background

Dunning (2008) [2] explains multinational firms undertake three forms of FDI, namely market-seeking, resource-seeking and efficiency-seeking. Market-seeking FDI is undertaken by firms that aim to gain access to markets with signs of strong economic growth and serving domestic or regional markets. Resource-seeking FDI is mainly for securing resources, such as raw materials, to be supplied to their supply chain or reserved for future production. The main motivation of efficiency-seeking FDI is to benefit from factors that enable it to compete in international markets, such as the availability of traditional factor endowments, cultures, institutional arrangements, economic systems and policies.

FDI can also be classified into horizontal and vertical forms (Helpman and Krugman, 1985) [3]. A company invests in the same business abroad as it operates domestically is a case of a horizontal FDI. Vertical FDI occurs if a company invests in a business that plays the role of a supplier or a distributor. Export platforms are suggested by Helpman et al. (2004) [4] as a “new motive” for FDI. Enterprises set up plants overseas not only to supply the host country’s market but also export to the host economy’s neighbouring countries. It should be noted that third-country export-platform FDI is defined as foreign enterprises whose output is generally sold in third markets other than the parent or host market. It also occurs when the host and third countries are inside a free-trade area and ODI firms can benefit from the free-trade area at the expense of the insider (Ekholm et al., 2007) [5].

After the reviewing of the most representative theories, the remainder of this section reviews the literature about the main determinants of FDI. The existing literature provides the rational basis for the hypothesis development of this paper.

2.2. Literature review and hypothesis development

Although multinational firms undertake different forms of FDI for different motivations, their decisions are all influenced by the investment climate and market characteristics of host countries. Factors related to the host country market are the most widely tested variables influencing FDI location decisions. To verify the possible vital determinants of China’s ODI in Southeast Asian countries, this paper puts forward the following eight hypotheses by combing with the literature review. The rational evidence are provided according to previous studies after each hypothesis.

H1. China’s ODI in Southeast Asian countries is significantly determined by host market size.

Many studies verify that China’s ODI has positive relationship with the market size of host countries. Chinese multinational firms engage in ODI for market-seeking motivations (Buckley et al., 2007; Kolstad I and Wiig, 2009) [1, 6]. Some studies argue that the effect of market size of host countries on FDI is different for different forms of FDI. Horizontal FDI attaches great importance to market potential of host countries while vertical FDI does not focus on it (Yokota and Tomohara, 2009; Markusen and Maskus, 2002) [7, 8].

H2. China’s ODI is negatively associated with the natural resource availability of host countries.

A number of studies suggests that Chinese enterprises have the motivations of securing natural resources in strategically important industries via ODI (Morck et al., 2008; Cheng and Ma, 2009) [9,
Many Chinese enterprises are involved in resource extraction in Southeast Asian countries with abundant resources such as Thailand, Cambodia, Lao PDR and Vietnam (Stephen Frost, 2004) [11]. Therefore, Chinese investment enterprises in Southeast Asian countries are likely to have resource-seeking motivations.

H3. China’s ODI is negatively affected by the labour costs of host countries.

Searching for lower labour cost is one of the basic motives behind FDI. A number of empirical results shows that higher labour cost of host countries affects FDI negatively (Bellak et al., 2008; Ismail and Yussof, 2003) [12, 13]. Because of the statistical caliber problem of wage level in different countries, Gross National Income (GNI) per capita is frequently used to represent the wage level of a country. In this paper, we also use GNI as a measure of labour cost to test the hypothesis.

H4. Chinese ODI is positively associated with the openness degree of the host countries.

Market openness is proved to contribute positively to the inflow of FDI by many scholars (Aizenman and Spiegel, 2006; Liargovas and Skandalis, 2012) [14, 15]. In general, host countries with higher degree of openness or host governments with policies conducive to overseas investors will contribute to higher levels of inward FDI (Ross, 2015) [16].

H5. China’s ODI has a negative relationship with the economic stability of host countries.

Economic stability of the host countries is also a key consideration for multinational investment (Alguacil et al., 2011) [17]. Buckley et al. (2007) [6] suggests a host country’s inflation level is a proxy for economic stability, high inflation level also indicates that a currency devaluation may be likely, thus reducing the investor’s real value of earnings.

H6. China’s ODI is positively associated with the infrastructure capacity of the host countries.

Infrastructure capacity is also likely to be a significant determinant of FDI. Well-developed infrastructure and communications networks in host countries are critical for coordination and control of FDI projects (Kolstad and Wiig, 2009; Ross, 2015) [1, 16].

H7. China’s ODI is significantly associated with China’s export to host countries.

The controversial relationship between export and FDI, whether they are complement or substitute, is always argued by scholars. It is generally accepted that horizontal FDI displaces export: instead of exporting, the firm sets up a subsidiary in the host country, trading off lower trade costs against higher fixed costs (Hoekman and Djankov, 1997; Markusen and Maskus, 2002) [18, 19]. However, vertical FDI complements export because the plant must exports its output as an intermediate good to other plants (Aizenman and Noy, 2006; Majeed and Ahmad, 2007) [20, 21]. By empirical testing, the relationship between China’s ODI and export to Southeast Asian countries can be further identified.

H8. China’s ODI is also attracted by the surrounding market potential of host countries.

Baltagi et al. (2007) [22] use surrounding market potential as a major explanatory variable to examine third countries’ effects on the location choice of FDI. The surrounding market potential indicates the market potential of the neighbouring countries of host economy and is defined as the spatially weighted third-market size of a given host economy i’s neighbours:

\[
s_{mp_i} = \sum_{j \neq i} \frac{1}{d_{ij}}gdp_j
\]  

In equation (1), \(d_{ij}\) is the distance between economy \(i\) and its neighbouring country \(j\), \(gdp_j\) indicates the market size of country \(j\) at time \(t\). Export-platform FDI is suggested to be attracted by surrounding market potential of host countries but it may be not of interest to horizontal FDI and vertical FDI, thus we make assumption first and test it later by empirical analysis.

According to the literature review and hypothesis development, factors corresponding to hypotheses are selected and to be tested by empirical analysis.

3. Data and methodology

3.1. Variable descriptions and data sources

The dependent variable \(invest\) is the number of Chinese overseas investment enterprises (institutions)
established in Southeast Asian countries which are approved by the Ministry of Commerce of China. The list of overseas investment enterprises is from the Department of Outward Investment and Economic Cooperation of Ministry of Commerce (MOFCOM), People’s Republic of China.

According to the literature review and hypothesis development, eight independent variables are selected to investigate the determinants of China’s ODI into Southeast Asian countries, namely, market size (gdp), natural resource availability (resources), labour cost (gnipc), openness (open), economic stability (inflation), infrastructure capacity (fetel), China’s export to host countries (export), and surrounding market potential of host countries (smp) respectively.

Table 1 highlights the descriptions and data sources of independent variables. The values of GNI per capita, export and surrounding market potential are converted into constant 2010 U.S. dollars using the GDP deflator.

Table 1. Descriptions of independent variables and sources of data.

| Variables | Proxy for | Sources |
|-----------|-----------|---------|
| gdp | GDP (constant 2010 US$) | World Bank |
| resources | Total natural resources rents (% of GDP) | World Bank |
| gnipc | GNI per capita (constant 2010 US$) | World Bank |
| open | Trade (%) | World Bank |
| inflation | Inflation:GDP deflator (annual %) | World Bank |
| fetel | Fixed telephone subscriptions (per 100 people) | World Bank |
| export | Total export value to host countries (constant 2010 US$) | National Bureau of Statistics of China |
| smp | Spatially weighted third-market size calculated by equation(1) CEPII & World Bank |

The data are taken into the natural logarithm form for each independent variable in regression. The descriptive statistics of all variables are showed in table 2.

Table 2. Descriptive statistics.

| Variable | obs | Mean | Std. Dev. | Min | Max |
|----------|-----|------|-----------|-----|-----|
| invest | 143 | 36.12 | 41.50 | 0 | 215 |
| gdp | 143 | 15.48 | 1.99 | 10.99 | 18.41 |
| export | 143 | 8.10 | 2.39 | 0.77 | 10.75 |
| resources | 143 | 1.18 | 3.08 | -8.07 | 5.84 |
| gnipc | 143 | 8.05 | 1.38 | 6.05 | 10.90 |
| open | 143 | 4.35 | 1.61 | -1.79 | 6.09 |
| inflation | 143 | 1.28 | 1.33 | -4.39 | 3.16 |
| fetel | 143 | 1.54 | 1.57 | -1.66 | 3.79 |
| smp | 143 | 12.42 | 0.31 | 11.64 | 12.97 |

3.2. Methodology

The dependent variable is the count data which is discrete and limited to non-negative values. Two main problems need to be considered when applying ordinary linear regression (OLS) to the count data. First, many distributions of count data are positively skewed with many observations in the data set having a value of 0 which prevents the transformation of a skewed distribution into a normal one. Second, OLS model will produce negative predicted values, which are theoretically impossible.
The most common technique employed to model count data is Poisson regression or its variants. The Poisson model commonly assumes the log-linear relationship between the parameter $\lambda_i^u$ and explanatory variables $x_{it}$, the log-linear conditional mean function of Poisson model is:

$$ E(y_{it}|x_{it}) = \lambda_{it} = e^{\beta_i x_{it} + \alpha_u} $$

and its variance is:

$$ \text{Var}(y_{it}|x_{it}) = \lambda_{it} $$

The Poisson model assumes the mean and variance are equal. When variance is larger than mean, the data is over-dispersed and negative binomial model is frequently used to account for over dispersion. In this paper, the mean of dependent variable $\text{invest}^{i}$ is 36.12 whereas the variance is 1721.97. It is obvious the data is over-dispersed, negative binomial model is considered to be adopted.

Greenwood and Yule (1920) [23] considers the negative binomial distribution as a mixture of a Poisson distribution with a Gamma mixing distribution. A useful way to motivate the negative binomial model is through the introduction of latent heterogeneity in the conditional mean of the Poisson model (Greene, 2008) [24]:

$$ E(y_{it}|x_{it}, u_{it}) = e^{(\beta_i x_{it} + u_{it})} = h_{it} \lambda_{it} $$

where $h_{it} = e^{u_{it}}$ is assumed to have a one parameter gamma distribution, $G(1/\alpha, \alpha)$ with mean 1 and variance $\alpha$, hence the variance of the negative binomial distributed random variable $y_{it}$ is:

$$ \text{Var}(y_{it}|x_{it}) = \lambda_{it} + \alpha \lambda_{it}^2 $$

$\alpha$ is also called the dispersion parameter which helps to choose between Poisson regression and negative binomial regression. When $\alpha$ is significantly different from zero, the distribution is over-dispersed and the negative binomial model is appropriate. When $\alpha$ approaches zero, the variance is almost equal to the mean, and the distribution can be simply modeled by Poisson regression.

Equation (4) can be rewritten into the log-linear model:

$$ \log(h_{it} \lambda_{it}^u) = \beta_i x_{it} + u_{it} $$

where the regression coefficient $\beta_i$ represents the expected change in the log of the mean $h_{it} \lambda_{it}^u$ for per unit change in the independent variables $x_{it}$. In other words increasing $x_{it}$ by one unit is associated with an increase of $\beta_i$ in the log of the mean $h_{it} \lambda_{it}^u$. The negative binomial model can be estimated by the standard maximum likelihood method.

In addition, if count data has an excess of zero counts, zero-inflated model needs to be adopted. For there are only 15 zero counts out of 143 observations in dependent variable $\text{invest}^{i}$, thus zero-inflated model is supposed to be not proper for the data. We will use Akaike Information Criterion (AIC) and Bayesian information criterion (BIC) to further verify if negative binomial model fits better than zero-inflated negative binomial model or not.

4. Empirical results and discussion

Table 3 shows the empirical results of the determinants of China’s ODI into Southeast Asian countries. The Likelihood Ratio (LR) test is to test for over dispersion. The null hypothesis of the test is "$\alpha = 0$" which implies the data comes from a Poisson distribution. The alternative hypothesis is "$\alpha \neq 0$" which implies the data is over dispersed. From the results of the negative binomial model (model 3), the 95% confidence interval of alpha is (0.273, 0.545), so it refuses the null hypothesis and strongly suggests the negative binomial model, estimating the dispersion parameter, is more appropriate than the Poisson model.
The values of AIC and BIC of negative binomial model are both lower than the values of zero-inflated negative binomial model (model 4), so they provide supports for standard negative binomial model rather than zero-inflated negative binomial model. Therefore, this paper only focuses on explaining the results of negative binomial model (model 3).

Results from model 3 highlight that China’s ODI is significantly determined by the market characteristics and investment climate of host countries, including the market size (H1), natural resource availability (H2), labour cost (H3), openness (H4), infrastructure capacity (H6) and surrounding market potential (H8). China’s ODI is also significantly related to China’s export to host countries (H7).

The coefficient of market size is 0.841 and significant. For each one-unit increase in market size of host countries, the expected log count of the number of Chinese enterprises increases by 0.841. It indicates China’s ODI is attracted by the market potential of host countries and has market-seeking motives. In recent years, Southeast Asian countries are seeing rapid economic growth and development. More and more foreign investors are attracted by the potential of boom market of Southeast Asian countries.

The effect of natural resource availability of host countries on China’s ODI is negative. High natural resource rents discourage Chinese investment. It implies China’s ODI activities are also driven by resource-seeking motives. The conclusion is consistent with the description of Stephen Frost (2004) that many Chinese enterprises in Southeast Asian countries are involved in resource extraction. Because of the negative consequences of rapid economic growth and globalization, Southeast Asian countries are now facing the challenges of sustainable development. Natural resources like coastal and marine resources are subject to over exploitation and pollution. It reminds Chinese enterprises to attach importance to the sustainable development goals of Southeast Asian countries and try to avoid conflict of interest in order to maintain the long-term sustainable cooperation.

China’s ODI is significantly negatively related with the labour costs of host countries. It indicates Chinese enterprises prefer to choose locations with lower labour cost and are driven by efficiency-seeking motivations. Most of the Southeast Asian countries are less developed countries or developing countries except for Brunei and Singapore. Countries like Cambodia, Laos, Vietnam and Myanmar are all low-income countries with abundant labor supply. It is obvious that the low labor cost in these countries is an important attraction for China’s ODI.

The coefficient of openness of host countries is significant and positive. It implies the higher the openness degree of host country is, the more Chinese investment enterprises are established in the host country. In fact, trade openness gives an indication of how well-integrated the host country is in the world economy. A higher openness degree reflects a friendlier investment climate and fewer regulations in host countries to some degree, and thus China’s ODI is expected to be attracted.

Infrastructure capacity of host countries is found to have a significant positive effect on China’s ODI. To keep pace with rapid economic growth, Southeast Asian countries need huge investments in transportation, telecommunication, and sanitation. The dependence between China’s ODI and host countries’ infrastructure capacity reminds us of paying attention to “mutual benefit” which is also the emphasis of the “Belt and Road” Initiative. By the “Belt and Road” Initiative, China’s ODI can help contribute to the infrastructure construction in Southeast Asian countries and it is foreseeable that in the future the barriers of host countries’ infrastructure to China’s ODI will get smaller.

Exports from China to host countries have significant negative association with the number of Chinese investment enterprises. Given this, the relationship between China’s exports and ODI to Southeast Asian countries is expected to be substitute other than complement. It is generally acknowledged that horizontal FDI substitutes for export while vertical FDI complements exports. For third-country export-platform ODI, its products are generally sold to third markets and thus will displace home country’s exports to third markets. Therefore, the significant negative relation between China’s ODI and exports to host countries provides evidence for the existence of horizontal FDI and export-platform FDI from China to Southeast Asian countries.
Market potential in surrounding areas of host countries is also a significant determinant of China’s ODI. The bigger the surrounding market potential is, the more Chinese investment enterprises are established in host countries. For surrounding market potential is a main consideration for export-platform FDI, the result offers evidence for export-platform China’s ODI in Southeast Asia countries.

However, the coefficient of inflation is negative but not significant. Thus it cannot confirm the hypothesis H5 that China’s ODI is negatively associated with host countries’ inflation level.

### Table 3. Empirical results of the determinants of China’s ODI and containing notea.

| Variables | Model | OLS | Poisson | NB | ZINB |
|-----------|-------|-----|---------|----|------|
| gdp       | 1     | 22.531 (6.837)*** | 1.140 (0.113)*** | 0.841 (0.140)*** | -0.226 (0.123)* |
| resources | 2     | -1.927 (1.364)    | -0.181 (0.023)*** | -0.0815 (0.033)** | -0.115 (0.038)*** |
| gnipc     | 3     | -14.802 (3.400)*** | -1.195 (0.093)*** | -0.913 (0.112)*** | -0.925 (0.104)*** |
| open      | 4     | 8.194 (1.109)***   | 0.272 (0.035)***  | 0.281 (0.039)***  | 0.0934 (0.051)*  |
| inflation | 5     | -3.037 (2.225)     | -0.039 (0.050)    | -0.106 (0.064)    | -0.275 (0.060)*** |
| fetel     | 6     | 5.285 (3.583)      | 0.600 (0.072)***  | 0.382 (0.099)***  | 0.584 (0.084)*** |
| export    | 7     | -16.842 (5.497)*** | -0.690 (0.098)*** | -0.411 (0.127)*** | 0.458 (0.125)*** |
| smp       | 8     | 93.952 (13.792)*** | 4.018 (0.312)***  | 3.729 (0.334)***  | 0.755 (0.077)*** |
| cons      | 9     | -1261.9 (227.327)*** | -51.578 (4.665)*** | -47.49 (5.188)*** | -14.32 (6.360)** |
| Inflates  |       |                 |                     |                 | -14.32 (6.360)** |
| _cons     |       | 0.385            | 0.771               |                 |                 |
| 95% Conf.Interval |       | (0.273 0.545) | (0.856 1.015) | | |
| Log pseudolikelihood |       | -906.4881 | -540.0635 | -575.2907 | |
| AIC       | 10    | 1384.68          | 1830.976           | 1100.127        | 1170.581        |
| BIC       | 11    | 1411.346         | 1857.642           | 1129.755        | 1200.21         |
| N         | 12    | 143              | 143                | 143             | 143             |

aSignificance at the 0.01, 0.05 and 0.10 level indicated by***,**,*; Robust standard errors in parentheses

5. Conclusions

This paper investigates the determinants of China’s ODI in Southeast Asian countries and is one of the first empirical papers to model China’s ODI in Southeast Asian countries using count data.

The empirical evidence suggests China’s ODI in Southeast Asian countries is driven by market-seeking, resource-seeking and efficiency-seeking motives which proves the applicability of Dunning’s theory. In another sense, evidence shows China’s ODI is determined by the investment climate or market characteristics of host countries: market size, openness and infrastructure capacity of host countries are significantly positive determinants of China’s ODI whereas the availability of natural resources and labour costs of host countries are both negative determinants of China’s ODI.

The study also identifies that China’s ODI and exports to Southeast Asian countries have competing relation and it to some extent provides evidence for export-platform FDI and horizontal FDI from China. The surrounding market potential of host countries is also an important consideration of Chinese investment firms which is always ignored by many scholars and the significant result further confirms the existence of export-platform ODI from China to Southeast Asian countries.
However, this paper has not provided any direct evidence for the vertical FDI from China to Southeast Asian countries while making no suggestion that it does not exist. Admittedly, the measurability by using the count data of the number of Chinese investment enterprises to represent China’s ODI is not all-inclusive and perfect for the quantity of China’s ODI cannot be reflected by the number of Chinese investment enterprises completely. The main purpose of using count data is to assess the determinants of China’s ODI from the perspective which is different from those of other researches that use ODI stock or inflow, to provide further evidence for the future research.

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