Investment Costs and The Determinants of Foreign Direct Investment

1. Introduction

In recent decades, most countries have experienced substantial increases in the worldwide inward and outward stocks of foreign direct investments (FDI). The majority of FDI has been the flow between industrial countries, the horizontal FDI; however, the FDI from the industrial countries to developing countries, the vertical FDI, has been a new trend recently. From the data, it is obvious that there is a considerable difference in the shares of outward FDI stocks among countries. Even though, there is a large body of literature on FDI, there are very few established results on the determinants of a country's competitiveness for FDI. Naturally, multinational firms decide their investment destination based a specific country where the most profit can be made in return. It is not a surprise that the host country try to set up its business and financial environment so that the cost of conducting business are relatively low enough to accommodate the multinational firms.

The costs of conducting business are highlighted in this paper, in particular the production cost, transaction cost and monitoring cost. These costs are only three out of many. Nevertheless, these three costs are considered as the critical factors on the investors' decision making. The way to measure these costs also imposes a difficulty on many researches applying each of these costs. This paper purposes the way to measure these business costs by constructing each cost from the smallest parts of business costs and then gathering up to complete each cost in measurable way.

The traditional theoretical works on FDI can be distinguished by the two ways that multinational enterprises (MNEs) conduct their business. Helpman (1984) constructed the theoretical model for vertical MNEs, which minimize their costs by locating their production plant in a region or country where firms can take advantage of differences in relative factor endowments. The transportation costs, tariffs, and tax-exclusive packages are not considered in the location decision. Helpman, Melitz and Yeaple (2004) insists the existence of the proximity-concentration trade-off in the horizontal FDI by the heterogeneous firms. On the other hand, Markusen and Venables (2000) emphasized the importance of trade costs and fixed investment costs for horizontal MNEs. This type of MNE prefers their production plants to be located in a country with a large demand for their product, with a similar relative factor endowment, and low trade costs. This argument is empirically consistent with the study by Markusen (1995).

In most of the empirical literature on the effects of the cost of doing business on the location of FDI, hypotheses are tested by applying the gravity model. The nested gravity equation is in double-log formation, which determines the relationships between the log of bilateral investment and the logged size of origin and destination economies and the log distance between them (Head & Ries, 2008). The following studies customized the based gravity equation to specifically study FDI and the costs of doing business. Razin, Rubinshtein, and Sadka (2005) demonstrate that the host-country tax rate affects the inward FDI, by applying the gravity equation with the Heckman selection method. As was found by Daude and Stein (2007), the differences in time zones, which affect the transaction cost, have a significant negative effect on the destination of investment. This transaction cost is not diminished by the development of information technologies. Head and Rei (2008) investigate with the gravity equation the effect of monitoring costs on bilateral FDI in the form of mergers and acquisitions.

This paper extends the partial equilibrium model from Hoonsawat (2008), where heterogeneous investors decide how much to invest in a specific destination based on the transaction costs and monitoring costs. Since the production costs is the major factor explaining the vertical FDI in these days, Helpman (1984) and Feenstra (2008), the model with only transaction costs and monitoring costs must lost its strength in describing the flows of investment from the industrial countries to developing countries. The extended model still preserves the model structure as that of Hoonsawat (2008). The model is begun by a simple inspection game[1] between an investor's headquarter and its oversea management team, which yield a mixed strategy Nash equilibrium as a result. The result determines the equilibrium transaction costs and monitoring costs faced by an investor. Then, this finding is added into a multinational firm's profit maximization problem[2].

In the next part of the model, the result from the inspection game is applied into the partial equilibrium model as a part of firm's cost measurement. The model cannot be completed without capturing the different in production costs among countries. A country with high production technology is able to produce with the lower average cost. Thus the production cost is differentiated among countries by the levels of production technology. Finally, the optimal amount of FDI made by each firm in a specific country can be summed the FDI amount up to the country level FDI so that we can conduct an empirical analysis on the model.

With the gravity specification, I test the significances of the vector of the proxies of transaction costs and monitoring costs for the bilateral FDI from 1980 to 1997. I find that the transaction costs and monitoring costs play a significant role in determining the amount of FDI stock. The major contributions from this paper are threefold.

First, the transaction costs, monitoring costs of cross-border investment and production costs are considered together for the first time. All costs are compiled into the firm-decision-making games, the solution from the game is straightforward. The game results

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1 The inspection game described in Fudenberg and Tirole (1991, p.17) as quoted by Head and Ries (2008)

2 Paragraph 3 and paragraph 4 are extracted from Hoonsawat (2007) p.75-76.

are then applied to the firm's profit maximization problem where the optimal amount of firm foreign investment is determined. This model allows us to test the hypotheses with a specification similar to that of the gravity equation. It is simple to set up but it gives an elegant explanation for firms' decision-making and is also consistent with the empirical evidence.

Second, this paper provides the connection between the theoretical model and the empirical analysis. Given that the data on FDI is available in the bilateral country level, to test the model, we need to gather the firms' foreign investment decisions by the same country source and country destination. Fortunately, the model allows us to do so.

Third, I define the transaction, monitoring costs and production costs in a measurable way. The transaction costs include the cost of transaction between a country outside and a country inside the Muslim world, the cost of communication between regions with different languages, and the corporate tax rate. The monitoring costs include the cost of differences in time zones, and the availability of communication tools and real-time internet. The production costs are determined by the productivity and technology levels in each country. I also test the consistency of each factor according to the theoretical explanation.

The remainder of the paper is composed of six sections. Section 2 presents the model and basic derivations. Section 3 presents the empirical specifications. Section 4 describes the data. The empirical analysis and results are presented by section 5. Section 6 is the conclusion.

2. The model

The model contains two parts. In the first part, the costs and benefit of outward foreign direct investment in a specific host country is determined under the framework of the principal-agent game between the headquarters of a MNE and an affiliate production plant. This game yields a Mixed strategy Nash equilibrium, which explains the firm's strategy to invest in a specific market. The second part of the model inserts the firm's costs and returns on foreign direct investment into the firm profit maximization problem to solve for the optimal investment amount. The model ends up with the gravity-like equation, which can be modified for the further empirical analysis and hypothesis testing.

2.1 *The costs and returns on cross-border investment*

In this subsection, I apply and preserve the game as Head and Ries have used it. As a part of their model, Head and Ries (2008) modified an "inspection" game to a game between a headquarter management team and the managers at an overseas subsidiary in a similar manner. The idea of the game is that headquarters can choose to trust or verify with a determined probability whether or not the subsidiary has worked. The subsidiary can choose whether to work or shirk with a specific probability. This game yields a mixed strategy Nash equilibrium as a result. Head and Ries add the monitoring costs as a function of distance.

However, I diverge on how the costs and benefits are defined and accounted for. The costs of investment include monitoring costs and transaction costs. The monitoring costs are positively correlated with distance and the difference in time zones between countries but the costs are decreased when the internet penetrations in both countries are improved. The transaction costs are separately defined as the cost of differences in the corporate tax rate, the costs of transaction between a country outside and a country inside the Muslim world, and the cost of communication between countries with different languages. I also add the production costs but these costs are translated in the form of the additional return when there is a different in technology levels between host and source countries. Thus the returns on investment made by the headquarter are different due to the benefit from the technology gap between technology level in the source country and technology level in the host country.

The background for the game is that a company has invested in new facilities is expanding existing facilities, or is trying to gain control over a foreign affiliate. The MNE headquarter (hereafter, HQ)[3] must monitor its affiliate plants (hereafter AF) to ensure that they are performing in the most efficient way. HQ pay cost *c* for monitoring AF agent, which AF chooses whether to work or not. If AF chooses to work, AF must put effort *e*. HQ receives the normal return *a*, even though the AF chooses to shirk and receives an additional return *b* when AF put their effort on works. HQ compensates *w* to AF for their efforts. The payoffs from the game are shown by the payoff matrix in Table 1.

Following Head and Reis, under the assumption[4], $(a+b) > w > e > c > 0$, there is no Nash equilibrium in pure strategies but a mixed-strategy Nash equilibrium. To observe the mixed strategy Nash equilibrium, let HQ conduct the monitoring activity with probability p_x.[5] The AF shirks with probability p_y. Thus, the AF's and HQ's expected payoffs are shown, respectively below,

$$u = w\left(1 - p_x p_y\right) - e(1 - p_y) \quad (1)$$

and $$v = a + b\left(1 - p_y\right) - cy - w(1 - p_x p_y)\ . \quad (2)$$

The optimized probability for AF to shirk, p_y, is equal to e/w and the optimized probability for HQ to monitor, p_x, is equal to c/w. The expected payoff for HQ under the

3 All of the notations in subsection 2.1 follow the notations used by Head and Ries (2008), except the notation of an affiliate plant.

4 Fudenberg and Tirole (1991, p. 17)

5 The probability of monitoring can be redefined by the proportion of monitoring time to the total working hours.

mixed strategy Nash equilibrium can be calculated by substituting the optimized probability into equation (2). as follows:

$$v^* = a + b(1 - {}^{c}/_{w})\,. \tag{3}$$

According to equation (3), the maximizing compensation to the AF's work, not shirking, can be calculated by taking the first derivative of equation (3) with respect to *w*. The maximizing compensation, *w*, is equal to $\sqrt{bc}$ and equal to 0 when HQ observes shirking. Substituting this result back in equation (3), we have the optimizing expected payoff for HQ that

$$v^* = a + b - 2\sqrt{bc}\,. \tag{4}$$

Up to this point, our model follows a part of Head and Ries' model. From this point on, the model will diverge from the one developed by Head and Ries. I now give the model empirical content by adding the function of monitoring costs, transaction costs and production costs into equation (4). Let us begin with the monitoring costs. The monitoring costs are functions of distance, real-time internet penetration of the origin and target countries, and the time-zone difference between origin and target countries. The greater the distance and time-zone difference between origin and target countries, the more difficult it is to verify the AF's work and the higher cost there is for monitoring HQ pays. Nevertheless, the effect of distance and time difference on the monitoring cost can be diminished by the availability of a real-time-monitoring tool via the internet in both countries. This presentation of the effect of distance and the real-time internet penetration refers to Freund and Weinhold (2004)[6]. Because people at night usually prefer to sleep, the difference in time zones affects real-time monitoring, as described by Daude and Stein (2007)

6 Freund and Weinhold (2004) showed theoretically that improvements in internet penetration reduce the importance of the effect of distance on trade volume; however, the change is not statistically significant over time.

The transaction costs are functions of differences in corporate tax rates, the country outside the Muslim world, and language. The difference in corporate tax rates across countries induces profit-shifting behavior by MNEs, from highly taxed jurisdictions to more lightly taxed locations. This process can be done illegally by setting transfer prices to minimize tax payments across countries in which they operate. There are studies, whose empirical results confirm the considerable transfer-pricing activities, such as for US transfer-pricing (Clausing, 2003), between OECD countries (Bartelsman and Beetsma, 2004), and OECD and developing countries (Hoonsawat, 2007).

The second factor in transaction costs is the Muslim world. Muslim countries, or countries in which Islam dominates politically, comprise many different nations and ethnic groups connected only by religion. This community has a unique financial and banking system. Since banks in the Muslim countries accept only financial instruments satisfied by Muslim financial standards[7] and since most of the business in Muslim countries runs on a working extending from Saturday to Wednesday, often with some non-government businesses working from Sunday to Thursday,[8] hidden costs for investment are generated and faced by non-Muslim MNEs. The last factor of transaction costs is the cost of communication between countries with different languages. This cost has been found to be significant in past studies of trade (Rose, 2004).

The production costs are introduced through the additional return received by HQ. HQ receives a higher additional return when it invests in a host country with a different production technology. For an example, a MN firm whose headquarter located in a

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7 Deposits would be managed under the Mudaraba arrangement, under which the customer is the Rabb-ul-Maal and the bank is the Mudarib. The bank, being the Mudarib, would be responsible for placing the funds in secured as-well-as profitable Islamic ventures on the basis of Ijarah, Murabaha, Mudaraba, etc and would share a portion of profits as a compensation for its efforts.

8 Business hours are varied, but are usually from 7am to 1pm and 4pm to 10pm. Government offices and banks are usually open from 8am to 2pm.

developed country invests in a subsidiary plant. This HQ will receive a higher additional return if its subsidiary plant is in a developing country. HQ from the developed country can take an advantage in the different production technology, labor-intensive production technology from the developing country, which is not available in the other developed country. Therefore, the different technology availability does not only reduce the cost of production but also increase the additional return, *b*, in the same time.

To incorporate transaction costs, monitoring costs and production costs into the model, costs are simplified by inserting three linear functions into equation (4). First, the transaction cost function is a linearly increasing function of the country outside the Muslim world and language differences, but a linearly decreasing function of corporate tax differences. Second, the monitoring cost function is a linearly increasing function of distance and time differences, but a linearly decreasing function of internet penetration. Lastly, the additional return function is an implicitly increasing function of the technology gap. The transaction costs, monitoring costs, and production cost between the origin country, *x*, and the target country, *y*, are given by, respectively,

$$T_{xy} = t(\tau_{xy}, \mu_{xy}, l_{xy}) \qquad \text{with} \quad t'_{\mu} > 0 \quad \text{and} \quad t'_{\tau}, t'_{l} < 0$$

$$M_{xy} = c_{xy} = \left[m(d_{xy}, x_x, x_y, z_{xy})/2\right]^2 \text{ with } m'_d, m'_z > 0 \quad \text{and} \quad m'_{x_x}, m'_{x_y} < 0,$$

and

$$B_{xy} = b\big(p(g_{xy})\big) \qquad \text{with} \quad p'_g < 0 \quad \text{and} \quad b'_p > 0$$

where τ_{xy} is the difference between the corporate tax rate of the origin country *x* and the target country *y* in absolute value; μ_{xy} is a dummy variable, which is equal to 1 if one out of two countries is in the Muslim world, and zero otherwise; l_{xy} is a dummy variable, which is equal to 1 if two countries use the same language, and zero otherwise; d_{xy} is the distance between country x and y; x_x and x_y are the internet penetration indices of countries x and y respectively; z_{xy} is the difference in time zones between countries x and y in absolute value and g_{xy}.

Combining equation (4) with the functions of transaction and monitoring costs, we can rewrite equation (4) as

$$v^* = a - t(\tau_{xy}, \mu_{xy}, l_{xy}) + b\big(p(g_{xy})\big) - \sqrt{b\big(p(g_{xy})\big)}\, m(d_{xy}, x_x, x_y, z_{xy}). \qquad (5)$$

Notice that the normal return, a, is subtracted from the transaction cost function. The reason is that the transaction costs trim the normal payoff from cross-border investment down proportionally. The transaction costs do not affect worker compensation in the AF as well as the AF decision whether to work or not to work. In the next subsection, I present the determination of the total FDI made by HQ in country x to the AF in country y. The technology different between countries x and y reduces the cost of production and then it raises the additional return received by HQ, b.

2.2 *The maximized profit MNEs*[9]

In order to determine the cross-border investment behavior of MNEs, I construct a partial equilibrium model. The model is developed from the model for trade volume of Hoonsawat (2007) and Freund and Weinhold (2004), to arrive at the present model with FDI. The model in this subsection is meant to be illustrative and highlight the ways in which the factors in transaction and monitoring costs are likely to have an impact on the level of bilateral FDI. I model the effects of the transaction and monitoring costs on FDI by assuming that they reduce the return on investing in a particular market.

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[9] This part of model is extracted from Hoonsawat (2007) p.84-89.

Let us consider a world with n countries, indexed by x or $y = 1, 2, \ldots, n,$ with a fixed number of firms, f_x. Each market for FDI is segmented and is in imperfect competition. These market conditions are important for representing a market with fixed costs. Firms will not invest in markets where returns are low and fixed investment costs are large, implying that the level of competition will differ across countries. The demand function for imperfect competition investment in country y is

$$r_y = K_y - I_y,$$

where r_y is the yield rate in country y, K_y is a constant, and I_y is the total inward investment from overseas to country y.

The MNE maximizes its net return by choosing the optimal amount for investing from the HQ located in country x to the AF located in country y. The objective function is shown in the following equation:

$$\max_{i_{xy}} R_{xy} - r_{xy} = i_{xy}\left[a - t + b - \sqrt{b}m\right] - r_{xy}\ , \qquad (6)$$

where i_{xy} is the amount of FDI of a firm in country x to country y, r_{xy} is the money loan rate or the opportunity cost for investment money for a firm in country x to invest in country y. Let the normal return from investing in country y be equal to the interest rate in that country, so that $a = r_y$. Substituting the demand function into equation (6), yields

$$\max_{i_{xy}} R_{xy} - r_{xy} = i_{xy}\left[K_y - i_y^* - i_{xy} - t + b - \sqrt{b}m\right] - r_{xy}, \qquad (7)$$

where i_y^* denotes the amount of FDI available in country y by other MNEs. The first order condition is

$$\frac{\partial R_{xy}}{\partial i_{xy}} = K_y - i_y^* - 2i_{xy} - t + b - \sqrt{b}m = 0 \qquad \text{for } x = 1, 2, 3, \ldots, n_y$$

or $$i_{xy} = \frac{1}{2}\left(K_y - i_y^* - t + b - \sqrt{b}m\right), \tag{8}$$

where n_y is the total number of firms competing in market y. In the second line of equation (8), the optimal investment in country y from a firm in country x is a function of investment from all other firms. Since each firm maximizes its profit by optimizing its cross-border investment, we can substitute the i_y^* with equation (8) for each firm. We can arrive at the optimal equilibrium amount, given that the HQ invests, by generalizing the number of firms in market y from 2 firms to n_j firms. The solutions are found to be

$$i_{1y} = \frac{1}{n_y+1}\begin{bmatrix} K_y + \left(\sum_{r\neq x} b_{ry} - n_y b_{1y}\right) - \left(\sum_{r\neq x} t_{ry} - n_y t_{1y}\right) - \\ -\sqrt{\left(\sum_{r\neq x} b_{ry} - n_y b_{1y}\right)\left(\sum_{r\neq x} m_{ry} - n_y m_{1y}\right)} \end{bmatrix}$$

or $$i_{xy} = \frac{\left[K_y + b_y - \bar{t}_y - \sqrt{b}\bar{m}_y\right]}{n_y+1} + \frac{n_y\left[\bar{t}_y - t_{xy}\right]}{n_y+1} + \frac{n_y\sqrt{b_y}\left[\bar{m}_y - m_{xy}\right]}{n_y+1} \quad , \tag{9}$$

where $\sum_{l\neq x} t_{ly} \approx (n_y - 1)\bar{t}_y$ $\sum_{l\neq x} m_{ly} \approx (n_y - 1)\bar{m}_y$ and $\sum_{l\neq x} b_{ly} \approx (n_y - 1)\bar{b}_y$.

In fact, the maximized net return from an investment of the MNE in country x to an AF located in country y is solved by substituting the amount of investment from equation (9) into the objective function, equation (7). The optimal gross returns are simply given as

$$R_{xy} = i_{xy}^2 .$$

A MNE will invest in an AF located in country y only if the net return is nonnegative. In other words, the gross return must cover the fixed cost of its investing money, r_{xy}. Each firm can access to loan at financial institution differently based on their expected profit, productivity, business reputation, etc. Hence, firms face the fixed cost of investing money differently, even if they are located in the same country and investing in the same country. Let r^{min} and r_{xy}^{max} denote the lower and upper bounds of the fixed cost of investing money for a firm located in country x investing money into country y. In this case, we assume that all country pairs have the same lower bound but a different upper bound, so that r^{min} does not have a subscript. The new firm will invest until the point where net returns are zero. Thus, the proportion of exporting firms in country *x* investing in market *y* to the total number of firms in country *x* is

$$s_{xy} = \int_0^{R_{xy}} f(g) = \frac{R_{xy} - r^{min}}{r_{xy}^{max} - r^{min}} = \frac{i_{xy}^2 - r^{min}}{r_{xy}^{max} - r^{min}} ,$$

where r_{xy}^{max} denotes the investing firm from country *x*, facing a fixed cost of investing money from country *x* to country *y*, which is drawn from a uniform distribution from r^{min} to r_{xy}^{max}.

The amount of the aggregate FDI from country *x* to country *y* is

$$I_{xy} = V_{xy} i_{xy} n_y , \tag{10}$$

where $$V_{xy} = max\left\{\frac{i_{xy}^2 - r^{min}}{r_{xy}^{max} - r^{min}}, 0\right\} .$$

V_{xy} in equation (10) represents an unobserved and endogenous variable that denotes the fraction of investing firms from country *x* to country *y*. With this investing share variable, we are allowed to determine the zero outward FDI from country *x* to country *y*. The zero-FDI country accounts for approximately 56 percent of the data, which I describe when discussing the problem of empirical estimation associated with the data in section (4).

Taking the logarithm and totally differentiating equation (10), we have

$$\frac{dI_{xy}}{I_{xy}} = \frac{1}{V_{xy}} \frac{dV_{xy}}{di_{xy}} \frac{di_{xy}}{i_{xy}} + \frac{di_{xy}}{i_{xy}} + \frac{dn_y}{n_y} = \left(1 + \frac{1}{V_{xy}} \frac{dV_{xy}}{di_{xy}}\right) \frac{di_{xy}}{i_{xy}}$$

$$= \left[1 + \frac{1}{V_{xy}} \frac{2i_{xy}}{(r_{xy}^{max} - r^{min})}\right] \frac{di_{xy}}{i_{xy}} \tag{11}$$

iff $$i_{xy}^2 > r^{min} .$$

Given that the number of MNEs in each country is assumed to be constant and exogenously determined, the last term of equation (11), $\frac{dn_y}{n_y}$, is equal to zero. The parenthesis in the second line has a positive value according to our condition; $i_{xy}^2 > r^{min}$. The full total differential of equation (11) can be achieved by substituting the first order differential of equation (9) into equation (11) for di_{xy} in the following;

$$\frac{dI_{xy}}{I_{xy}} = \overbrace{\frac{1}{i_{xy}(n_y+1)}}^{(+)}\left[1 + \overbrace{\frac{2i_{xy}}{V_{xy}(r_{xy}^{max} - r^{min})}}^{(+)}\right]\left[\frac{dK_y}{K_y} + \overbrace{\left(1 + \frac{(n_y-1)\bar{m}_y - m_{xy}}{2\sqrt{b_y}}\right)}^{(+/-)}\frac{db_y}{b_y} - \right.$$
$$\left. - n_y\sqrt{b_y}\frac{dm_{xy}}{m_{xy}} - n_y\frac{dt_{xy}}{t_{xy}}\right] \qquad (12)$$

iff $\qquad i_{xy}^2 > r^{min}$.

According to equation (12), we can make a theoretical conclusion that transaction costs and monitoring costs have a negative relationship to the country's FDI. In other words, increasing transaction costs or monitoring costs or both will lead to a decrease in the country's FDI. The country FDI also depends positively on the target country's market size; however, the direction for the return from working premium is ambiguous. Equation (10) has characteristics that closely resemble the traditional gravity equation, but the model does not include the target country's market size variable.

A summary of the factors that theoretically have an impact on the aggregate amount of a country's FDI is shown in Table 2. In this table, I list the direction of each impact factor on the country's FDI categorized by transaction costs and monitoring costs, such as time-zone differences, internet penetration, and common language, etc. These impact factors' directions are implied by the total differentiation that is shown by equation (12).

3. Empirical specifications

In progress

4. Data

In progress

5. Empirical results

In progress

6. Conclusion

In progress

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Table 1
The principal-agent game

		Headquarters	
		Trust ($1 - p_x$)	Verify (p_x)
Affiliate plant manager	Shirk (p_y)	$w, a - w$	$0, a - c$
	Work ($1 - p_y$)	$w - e, a + b - w$	$w - e, a + b - w - c$

Table 2
The impact factors on a country's FDI

Factors	Direction
Transaction costs	
Corporate tax differences	(+)
Muslim world	(+)
Common language	(+)
Monitoring Costs	
Distance	(-)
Exporting country internet	(+)
Importing country internet	(+)
Time-zone differences	(-)
Production costs	
Differences in production technology	(+)