THE EXCHANGE RATE EFFECTS ON THE DIFFERENT TYPES OF FOREIGN DIRECT INVESTMENT

by

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Motivated by conflicting prior evidence for exchange rate effects on foreign direct investment (FDI), the first chapter of this dissertation explores theoretical evidence of the exchange rate effect on FDI in terms of different types of FDI. Based on a simple two-country model, I demonstrate that the profit function of a horizontal FDI investor is a decreasing function of the exchange rate, while the profit function for a vertical FDI investor is an increasing function of the exchange rate. This implies that a depreciation of a host country currency depresses horizontal FDI and promotes vertical FDI. Moreover, comparing the FDI investor's intertemporal profit in a simple two-period time frame, I lay out a theoretical basis for a relation between the effects of the exchange rate and the expectations of the exchange rate effect on different types of FDI.

The second chapter of this dissertation examines the empirical evidence for the exchange rate effects on different types of FDI. Using cross-border mergers and acquisitions among 37 countries from 1985 to 2007, I measure horizontal and vertical FDI in 4 different ways, and constructing directional country pairs, I estimate the exchange rate effects on horizontal and vertical FDI by a Poisson and a negative binomial regression with fixed and random effects. The estimation results provide considerable support for the model's predictions of the first chapter.

The third chapter of this dissertation extends the first and second chapters with an analysis of the effect of exchange rate expectations on different types of FDI. I examine 4 different measures of exchange rate expectations. Using a methodology similar to that in the second chapter, the estimation results suggest that the expected exchange rate effects on horizontal and vertical FDI are not very significant. However, the expectations of the exchange rate shed more light on the exchange rate effects on different types of FDI under all of the exchange rate expectation measures. This suggests that the exchange rate is a more influential determinant of the allocation of different types of FDI than the expected exchange rate.

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CHAPTER I

THE EXCHANGE RATE EFFECTS ON THE DIFFERENT TYPES OF FOREIGN DIRECT INVESTMENT: THEORETICAL EVIDENCE

Preface

Exchange rate movements are a fundamental factor in the global economy, determining the allocation of resources internationally and affecting the profitability of everyday international transactions. Likewise, exchange rates influence the allocation of foreign direct investment (FDI) and the profitability of such investments. Therefore, the relation between the exchange rate and FDI has been an interesting and important topic to the prior literature.

Previous studies examine various aspects of the relation between the exchange rate and FDI including exchange rate level, exchange rate volatility, exchange rate expectations, and the motives behind FDI decisions (See the first chapter for more). Taken as whole, however, these studies do not show conclusive evidence for the nature of these relationships. Especially, there is inconclusive evidence in theory and in empirics for the relation between exchange rate level and FDI. In this dissertation, I attempt to reconcile these inconsistent observations by examining the relation between exchange rate level and FDI in terms of different types of FDI.

I divide FDI broadly into horizontal FDI and vertical FDI because I postulate that horizontal FDI and vertical FDI have different implications for the foreign direct investor's profit. Horizontal FDI implies the exact replica of the foreign direct investor's home production, so it necessarily involves a foreign currency transaction that includes both the revenue and the cost of his production aboard. On the other hand, vertical FDI may involve a foreign currency transaction that includes only the cost side of his overseas production because vertical FDI is associated with only the part of the foreign direct investor's home production processes. As a result, while the exchange rate affects both the revenue and the cost of horizontal FDI, the exchange rate affects only the cost of vertical FDI.

A simple theoretical model in the first chapter of my dissertation demonstrates these different implications of horizontal FDI and vertical FDI. The model shows that a deprecation of a host country currency is negatively correlated with the horizontal FDI investor's profit, while a depreciation of a host country currency is positively correlated with the vertical FDI investor's profit. This may suggest that a depreciation of a host country currency depresses horizontal FDI into that country, while a depreciation of a host country currency promotes vertical FDI into that county.

The second chapter of my dissertation tests these theoretical predictions of the first chapter. Controlling for the determinants of FDI identified by the model in the first chapter, I analyze the relation between bilateral exchange rates and cross-border mergers and acquisitions (M&A) among 37 countries from 1985 to 2007.

The results of the analysis reveal considerable support for the model's predictions in the first chapter that a depreciation of a host country currency depresses horizontal FDI into that country, whereas a depreciation of a host country currency promotes vertical FDI into that county. The results also reveal that the exchange rate effects on different types of FDI can be improved with more careful measures of horizontal FDI and vertical FDI.

Another consideration regarding the exchange rate effects on different types of FDI is the role of investor's expectations of the exchange rate. This is because the expectations of the exchange rate have the exact same effect on the expected foreign investor's profit as the exchange rate does on the foreign investor's profit. Foreign direct investors likely need to decide the timing of FDI in relation to the expected profit generated by engaging in FDI in this period versus future periods. The simple two-period model in the first chapter exactly illustrates this point. Comparing the intertemporal foreign direct investor's profit, the model shows that the expectations of the exchange rate could affect timing of FDI and therefore the ultimate exchange rate effects on different types of FDI (See the first chapter for more).

The third chapter of my dissertation examines how the expectations of the exchange rate affect the exchange rate on different types of FDI, and also explores how robust the expected exchange rate effects on different types of FDI are to the various measures of the expected exchange rate under different assumptions of exchange rate expectations: Perfect forecast expectation, adaptive expectation, rational expectation and risk-adjusted rational expectation.

Using a similar econometric methodology as in the second chapter, the analysis reveals that the expected exchange rate effects on different types of FDI are not robust under the different assumptions of exchange rate expectations and the expected exchange rate doesn't seem to have significant effects on different types of FDI either. However, the analysis shows that the expectations of the exchange rate sheds more light on the exchange rate effects on different types of FDI under all of the exchange rate expectations. This may imply that the exchange rate is a more influential determinant of the allocation of different types of FDI than the expected exchange rate is.

Hopefully, these findings of my dissertation provide new insight into the relation between the exchange rate and FDI. The specifics and details are explained in each of the following chapters.

I.1. Introduction

The exchange rate is a price that determines the allocation of resources internationally. How the exchange rate affects the allocation of foreign direct investment (FDI) has been studied extensively, but there is inconclusive evidence for the exchange rate effects on FDI in theory and in empirics. Froot and Stein (1991), Stevens (1993) and Blonigen (1997) suggest that a depreciation of a host country currency may increase FDI into that country, whereas Campa (1993), Tomlin (2000) and Chakrabarti and Scholnick (2002) propose that a depreciation of

a host country currency may decrease FDI into that country. Alternatively, Cushman (1985) shows that the effects of the exchange rate on FDI may be ambiguous.

However, a careful review of these studies reveals significant differences in how FDI is modeled and the type of FDI that is assumed. In effect, it is difficult to find a single study that explicitly models different types of FDI. Froot and Stein (1991) and Blonigen (1997) model FDI as a type of asset-seeking FDI. Campa (1993) and Chakrabarti and Scholnick (2002) model FDI as market-seeking FDI, while Cushman (1985) models different cases of FDI, of which one case is vertical FDI and another case is similar to horizontal FDI (see section I.2 for a review).

In terms of a type of FDI, asset-seeking FDI and market-seeking FDI can be either horizontal FDI or vertical FDI. Horizontal FDI is defined as FDI in the exact same industry abroad as where a foreign direct investor operates in his own country, while vertical FDI refers to FDI in an industry abroad that is related to the foreign direct investor's production stages (processes) in his own country (see section I.3 for more). So, if a foreign direct investor seeks an asset abroad that is associated with his home production stages, the asset-seeking FDI is vertical FDI, but, by contrast, if a foreign direct investor seeks an asset abroad that can duplicate his entire home production processes, then this asset-seeking FDI is horizontal FDI.[1]

Likewise, when a foreign direct investor seeks a market abroad by engaging in FDI that duplicates his entire home production processes, this market-seeking

[1] In order for foreign investment to be qualified as FDI, the foreign direct investor must have *control* over his foreign affiliates.

FDI is horizontal FDI. Conversely, when a foreign direct investor seeks a market abroad by engaging in FDI that is associated with his home production stages, this FDI is vertical FDI. Thus, FDI can be broadly divided into horizontal FDI and vertical FDI.

Above all, dividing FDI into horizontal FDI and vertical FDI is very useful to examine the exchange rate effects on FDI because horizontal FDI and vertical FDI have different implications for the foreign direct investor's profit. Horizontal FDI implies the exact replica of the foreign direct investor's home production, so it necessarily involves a foreign currency transaction that includes both the revenue and the cost of his production abroad. On the other hand, vertical FDI may involve a foreign currency transaction that includes only the cost side of his overseas production because vertical FDI is associated with only the part of the foreign direct investor's home production processes (producing an intermediate input abroad is a good example of vertical FDI; see section I.3 for more). As a result, while the exchange rate affects both the revenue and the cost of horizontal FDI, the exchange rate affects only the cost of vertical FDI.

So, intuitively, vertical FDI may have the cost saving of utilizing relatively less expensive factors when a host country currency depreciates. Horizontal FDI, however, may have the cost saving, along with the revenue loss brought by a depreciation of a host country currency. This suggests that while a depreciation of a host country currency may be conducive to vertical FDI into that country, a depreciation of a host country currency may not be so to horizontal FDI into that

country if the revenue loss is larger than the cost saving. This very intuition is demonstrated in extending the model of Aizenman and Marion (2004) (see the following section for more). I demonstrate that a depreciation of a host country currency may stimulate vertical FDI into that country, while a depreciation of a host country may depress horizontal FDI into that country.

Moreover, the expectations of exchange rate movements can also affect the allocations of FDI because the expectations of the exchange rate affect the future profit of a foreign direct investor. If the profit generated by engaging in FDI in the future exceeds the profit generated by engaging in FDI in the present, a foreign direct investor may postpone his FDI until the future. Otherwise, the foreign direct investor may bring forward his FDI. Comparing the intertemporal profit in a simple two-period time frame, I show that there exists a certain level of depreciation of a host country currency at which a foreign direct investor would delay his FDI. The analysis also reveals that the threshold of depreciation of a host country currency for horizontal FDI and vertical FDI differs.

More importantly, the expectations of the exchange rate will shed more light on the exchange rate effects on different types of FDI because a foreign direct investor could alter the timing of FDI in light of the expectations of the exchange rate. If a host country currency is expected to depreciate more than the threshold of depreciation, a foreign direct investor would postpone his FDI until the future. Then, this implies that the expectation of the exchange rate may weaken the exchange rate effects.

On the contrary, if a host country currency is expected to depreciate less than the threshold of depreciation (or, appreciate), a foreign direct investor would bring forward his FDI. In this case, the expectations of the exchange rate may strengthen the exchange rate effects on FDI. These interesting dynamics of the exchange rate and the expectations of the exchange rate are analyzed in this chapter, and will be investigated more thoroughly in later chapters.

The rest of this chapter is organized as follows. The next section briefly reviews previous studies of the exchange rate effects on FDI, and section 3 lays out a theoretical prediction for the exchange rate effects on different types of FDI. Section 4 presents the effect of the expectations of the exchange rate on different types of FDI. The last section discusses further research agendas and concludes.

I.2. Literature Review

The relation between the exchange rate and FDI has been studied in terms of exchange rate movements and exchange rate volatility. As an example of studies, Campa (1993) applies Dixit's option pricing model to examine the effect of the exchange rate volatility, the exchange rate and the expected exchange rate on FDI.

Campa considers a foreign firm that produces output in its own country and sells it at a constant market price (in dollars) in the U.S. market. However, the firm needs to make investment (i.e., incur a sunk cost) in order to enter the U.S. market. Applying the option pricing model to assess this foreign investment, Campa compares the present value of the firm's expected future profits from entering the

U.S. market with the firm's cost of entering the market. Based on the comparison, Campa shows that exchange rate volatility decreases FDI, and both the depreciation and the expected depreciation of the U.S. dollar decrease FDI. [2,3]

To empirically test his claims, Campa constructs a measure of the expected exchange rate movement under the assumptions of perfect forecast expectation and static expectation. Under the perfect forecast expectation, the foreign firm is assumed to have a perfect forecast of the exchange rate for the next 2 years, so that the realized actual exchange rate in the two years *after* the firm's entry is used as the measure of the expected exchange rate. Alternatively, under static expectations, the firm is assumed to take the exchange rate in the two years prior to the firm's entry as the expected exchange rate, so the historical exchange rate in the two years *before* the firm's entry is used as the estimate of the expected exchange rate. Additionally, Campa measures the exchange rate volatility by the standard deviation of the exchange rate.

Examining FDI into the U.S., Campa confirms that a rise in exchange rate volatility decreases FDI, and the depreciation of the U.S. dollar decreases FDI. However, his empirical study shows that the expected depreciation of U.S. dollar

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[2] According to the option pricing model, the value of an option increases with an increase in the volatility of the underlying asset of the option. So, at any given period, a foreign firm will not exercise an option to enter the U.S. market and hold it for another period as long as the expected return from holding the option is greater than the expected return from exercising the option (i.e., the expected return from serving the U.S. market for that period). When the exchange rate of the U.S. dollar becomes volatile, the foreign firm will not enter the U.S. market (i.e., will not exercise the option) because the value of the option increases with an increase in the volatility of the exchange rate. As a result, FDI decreases as the exchange rate become more volatile.

[3] Campa denotes the exchange rate in foreign currency per U.S. dollar (i.e., a foreign firm's country currency over a host country currency).

under perfect forecast expectation has less conclusive effects on FDI, and the expected depreciation of the U.S. dollar under static expectations has an effect on the FDI that is not consistent with his theoretical predictions.[4] However, Campa explains that the conflicting effect of the expected exchange rate on FDI may be due to the fact that a firm cannot correctly predict the exchange rate.

Note that Campa's analysis of the exchange rate effect on FDI directly contradicts Froot and Stein (1991), and Blonigen (1997). Campa reasons that the contradiction is attributable to different FDI data. In effect, Froot and Stein (1991) use the FDI data of manufacturing industries whereas Campa uses the FDI data of non-manufacturing industries. Nevertheless, Tomlin (2000) shows that Campa's empirical result may be sensitive to model specification.

Cushman (1985) examines the effects of the exchange rate and the expected exchange rate on FDI under four cases. Each case is a combination of where to produce output, where to sell output, and where to finance inputs, especially capital.[5] Cushman assumes that a firm needs capital investment in the first period so that it can generate profit in the next period (it is a two-period model). In each case, the firm maximizes the certainty equivalent of the future (the second period) real

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[4] Campa also examined different samples by each country and by a group of countries, but the results are not significantly different.

[5] Cushman's four cases do not fit the standard definition of FDI very well (See Markusen and Maskus (2001) for the definition). The 4 cases are: (1) a firm produces and sells output abroad using foreign inputs with capital financed either at home or abroad; (2) a firm produces and sells output abroad using imported intermediate goods from home with capital financed only at home; (3) A firm produces and sells output at home using imported intermediate goods from foreign subsidiaries whose capital financed at home; and (4) a firm can choose either to produce at home with capital financed at home to sell abroad, or to produce abroad with capital financed at home to sell abroad.

profit in the firm's own country currency, and it is assumed that the firm must estimate the expected exchange rate change in order to maximize the certainty equivalent.[6,7]

Based on the profit maximization principle, Cushman shows that the exchange rate effect on FDI is positive for case 2, but negative for cases 1, 3 and 4, and the expected exchange rate effect on FDI is positive for cases 1 and 2, but inconclusive for cases 3 and 4. More specifically, the first order conditions of the second case, where a firm produces and sells output abroad using imported intermediate goods from home with capital financed only at home, imply an appreciation and the expected appreciation of a host country currency increase FDI into that country because both the appreciation and the expected appreciation lowers the marginal cost of capital.

To test his theoretical predictions, Cushman constructs a measure of the expected exchange rate change under the assumption of stabilizing expectations (i.e., a mean reverting behavior of the exchange rate) and regressive expectations.[8]

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[6] The certainty equivalent is $C = E(\pi) - \gamma\sigma_{\pi}$, where $E(\pi)$ is the expected real profit, γ is market price of risk, and σ_{π} is the standard deviation of the real profit. That is, the firm is assumed to be risk-averse.

[7] The expected exchange rate change is $\psi = E(\theta) - \gamma\sigma_{\theta}$, where $E(\theta)$ is the expected exchange rate change. γ is market price of risk, and σ_{θ} is the standard deviation of the exchange rate. Thus, it is the risk-adjusted expected exchange rate change that the firm estimates. The exchange rate is the price of a host country currency in terms of the firm's own country currency (i.e., the firm's own country currency per a host country's currency).

[8] Stabilizing expectations and regressive expectations are similar. Under stabilizing expectations a firm expects the exchange rate to appreciate (depreciate), on average, in the next period if the exchange rate depreciates (appreciates) in the current period. Under regressive expectations, a firm expects the exchange rate would converge to a mean value (a long run value) in the future.

Under both the exchange rate expectation assumptions, he uses the weighted average of the exchange rate as the estimate of the expected exchange rate.

Analyzing U.S. FDI into five industrialized countries, Cushman reports not only a statistically significant negative exchange rate effect on the FDI but also a statistically significant negative effect of the expected exchange rate on the FDI under both the exchange rate expectations. That is, both depreciation and the expected depreciation of a host country currency increase FDI into that country.

Unlike the previous two studies, Chen *et al.* (2006) divide FDI into two groups: market-oriented FDI and cost-oriented FDI. Interestingly, they investigate the relation between exchange rate movements and FDI in terms of different motives behind FDI decisions. Evaluating market-oriented FDI and cost-oriented FDI with Dixit's real option model, as in Campa (1993), they show that a depreciation and the expected depreciation of a host country currency have a negative correlation with market-oriented FDI into that country, whereas a depreciation and the expected depreciation of a host country currency have a positive correlation with cost-oriented FDI into that country.

In order to verify their claims, the authors construct a measure of the expected exchange rate change by means of the exchange rate trend. Examining FDI into China from Taiwan, they find supportive evidence for their claims that while a depreciation and the expected depreciation of a host country currency reduce market-oriented FDI into the country, a depreciation and the expected depreciation of a host country currency stimulate cost-oriented FDI into the country.

Like Chen *et al.* (2006), I too divide FDI into two groups, but I focus on types of FDI because a different type of FDI has different implications for the foreign direct investor's profit (see section I.3 for more). Decomposing FDI into horizontal FDI and vertical FDI, I examine how the exchange rate affects the allocation of different types of FDI. I do so by extending the model of Aizenman and Marion (2004). Since their study is intended to investigate the impact of uncertainty through productivity shocks, demand shocks and investment risk on horizontal FDI and vertical FDI, I use their model of horizontal FDI and vertical FDI.

However, while absolute PPP holds in Aizenman and Marion's model, I depart from absolute PPP because the deviation allows me to extend their model to incorporate the effects of the exchange rate on different types of FDI.[9] Moreover, the exchange rate effects are combined with an analysis of exchange rate expectations on FDI later on. It is my hope that the insight of different types of FDI may contribute to reconciling the less conclusive evidence for the exchange rate effect on FDI.

I.3. Exchange Rate Effects on Different Types of FDI

This section presents a simple model to examine the exchange rate effects on different types of FDI. Consider a world economy with two countries, Home and Foreign. Each country consumes two final goods, C and Y. The utility of the Home representative consumer is given by

[9] There are many good reasons why absolute PPP does not hold. See Krugman and Obstfeld (2007).

$$(1) \qquad U(C,Y) = C + \frac{A}{\delta}Y^{\delta} \;\; s.t. \;\; C + P_Y Y = m, 0 < \delta < 1,$$

where A and δ are preference parameters, m is income, and P_Y is the relative price of the final good Y in the units of final good C. The price of the good C is normalized to 1.

The utility maximization conditions yield the demand for final good Y in Home as

$$(2) \qquad P_Y = AY^{\delta-1} \;\; or \;\; Y = (A/P_Y)^{\frac{1}{1-\delta}}$$

Assuming identical preferences for the Foreign representative consumer, the demand for final good Y in Foreign is

$$(3) \qquad P_Y^* = A(Y^*)^{\delta-1} \;\; or \;\; Y^* = (A/P_Y^*)^{\frac{1}{1-\delta}}$$

An asterisk (*) indicates Foreign.

Suppose that the final good C is produced in both Home and Foreign with a simple production technology,

$$(4) \qquad C = L_C \;\; and \;\; C^* = a^* L_C^* ,$$

where L_C and L_C^* is the labor used in producing the good C in Home and Foreign. a^* is the labor productivity in Foreign, and the labor productivity in Home is 1. Assuming that the labor market in Home and Foreign are perfectly competitive, the labor productivity implies that the real wage in Home is 1 and the real wage in Foreign is a^*.

Suppose further that the final good Y is produced only by a monopolist headquartered in Home, and that the monopolist engages in either horizontal FDI or vertical FDI to produce the good Y. Since final good Y is produced in Home only, the Foreign demand for the good Y is subject to exchange rate movements. Expressing the exchange rate (e) as the price of the Home currency in terms of the Foreign currency, the Foreign demand for the good Y can be written as

$$Y^* = (A/P_Y^*)^{\frac{1}{1-\delta}} = (A/eP_Y)^{\frac{1}{1-\delta}} \tag{5}$$

Given the price of final good Y in the Home currency (P_Y), the Foreign demand for the good Y decreases as the Foreign currency depreciates (i.e., e increases), because final good Y becomes relatively more expensive to the Foreign consumer. The exchange rate is the real exchange rate because all prices are expressed in the units of the good C. And, it is assumed that the exchange rate is exogenously given.

The following subsections turns to explaining how the exchange rate movements affect different types of FDI. It should be noted that the model is

abridged in many ways to highlight the exchange rate effects on different types of FDI.

I.3.1. Horizontal FDI

Horizontal FDI is defined as FDI in the exact same industry abroad as the foreign direct investor operates in his own country. Specifically, horizontal FDI implies that a foreign direct investor duplicates its home production abroad and serves the foreign markets with the duplicated production. [10]

In keeping with the definition of horizontal FDI, suppose that the monopolist headquartered in Home duplicates its Home production of final good Y in Foreign, so that final good Y is produced in both Home and Foreign. Using a simple Cobb-Douglas production technology in both countries, the total production of the monopolist engaging in the horizontal FDI is

$$Y = \sqrt{L_Y} + \sqrt{L_Y^*}, \tag{6}$$

where L_Y and L_Y^* are the labor employed in producing final good Y in Home and Foreign respectively.

As the production in each country serves each market,

$$Y = \sqrt{L_Y} \text{ and } Y^* = \sqrt{L_Y^*} \tag{7}$$

[10] I follow Markusen and Maskus (2001) for the definition of horizontal FDI and vertical FDI.

Then, the profit (π) of the monopolist denominated in the Home currency is

$$\pi = P_Y Y + \frac{1}{e} P_Y^* Y^* - L_Y - \frac{1}{e} w^* L_Y^* , \tag{8}$$

where $w^* = a^*$ for easy notation.[11]. Given the inverse demand for final good Y in Home (2) and Foreign (3), and the market clearing condition (7), the profit maximizing level of Y and Y^* is[12]

$$\bar{Y} = (\delta A/2)^{\frac{1}{2-\delta}} \; and \; \bar{Y}^* = (\delta A/2w^*)^{\frac{1}{2-\delta}} \tag{9}$$

It follows that the profit maximizing level of L_Y and L_Y^* is

$$\bar{L}_Y = (\delta A/2)^{\frac{2}{2-\delta}} \; and \; \bar{L}_Y^* = (\delta A/2w^*)^{\frac{2}{2-\delta}} \tag{10}$$

Notice that $\bar{Y}^*$ and $\bar{L}_Y^*$ are not affected by the exchange rate. That is because of the way horizontal FDI is defined (see equation (7)). The monopolist's profit, however, is affected by the exchange rate, once it is translated into the Home currency (see equation (8)).

Based upon the maximized profit, it can be shown that[13]

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[11] Recall that the competitive real wage in Foreign is a^*, and the competitive real wage in Home is 1.

[12] The second order condition with respect to Y confirms that the profit is maximized.

(11) $$\frac{\partial \pi}{\partial e} < 0$$

It means that a depreciation of the Foreign currency (i.e., an increase in e) reduces the profit of the monopolist engaging in horizontal FDI. As the Foreign currency depreciates, the cost of FDI (the Foreign wage) in the Home currency falls, but at the same time the revenue in the Home currency falls as well. In this case, however, the revenue loss is larger than the cost saving. The relatively large revenue loss associated with the depreciation is attributed to the negative relation between the monopolist's profit and a depreciation of the Foreign currency.

As a result, the inequality suggests that a depreciation of the host country currency is correlated with a decrease in horizontal FDI into that country. This negative effect of the exchange rate on FDI is similar to Campa (1993), Chakrabarti and Scholnick (2002), and Chen *et al.* (2006).

I.3.2. Vertical FDI

Vertical FDI refers to FDI in an industry abroad that is related to the foreign direct investor's production stages (processes) in his own country. As a representative case, when a foreign direct investor makes a direct investment abroad so as to produce intermediate inputs, and imports those inputs back for

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[13] See the appendix for derivation.

further processing in his own country, the FDI is considered to be vertical FDI (see Markusen and Maskus (2001) for more).

Following the above case, suppose that the monopolist needs an intermediate input (M) to produce final good Y. The intermediate input is produced in Foreign with a Cobb-Douglas production technology given by

$$M = \sqrt{L_M^*}, \tag{12}$$

where L_M^* is the labor employed to produce input M in Foreign, and the input is imported back to Home for further processing. Suppose also that the monopolist uses a Leontief production technology in Home to produce final good Y. Then, the final good is completed by combining intermediate input M with labor in Home. Accordingly, the final production of the monopolist engaging in vertical FDI is,

$$Y = min\{M, \sqrt{L_Y}\} \tag{13}$$

Since vertical FDI implies that final good Y is sold only at Home, the profit (π) of the monopolist denominated in the Home currency is

$$\pi = P_Y Y - L_Y - \frac{w^*}{e} L_M^* \tag{14}$$

Given the inverse demand for final good Y (2), and the production technology (13), the profit maximizing level of L_Y, L_M^* and Y is found as[14]

$$\bar{L}_Y = \bar{L}_M^* = \bar{Y}^2 \ and \ \bar{Y} = \left(\frac{\delta A}{2}\right)^{\frac{1}{2-\delta}} \left(\frac{e}{e + w^*}\right)^{\frac{1}{2-\delta}} \tag{15}$$

By the envelope theorem, it can be shown that[15]

$$\frac{\partial \pi}{\partial e} > 0 \tag{16}$$

The inequality implies that a depreciation of the Foreign currency (i.e., an increase in e) increases the profit of the monopolist engaging in vertical FDI. Intuitively, as the Foreign currency depreciates, the cost of production (the Foreign wage) in the Home currency falls, and so the monopolist's profit increases. This implication is a stark contrast to that of horizontal FDI. When the monopolist engages in horizontal FDI, there is a negative relation between the monopolist's profit and a depreciation of the Foreign currency, but now there is a positive relation between them.

The reason for this sign reversal lies behind different types of FDI. Unlike horizontal FDI, the monopolist engaging in vertical FDI does not serve the Foreign market. Therefore, there is no revenue loss associated with a depreciation of the Foreign currency. Only the cost saving induced by the depreciation is a relevant

[14] The second order condition with respect to Y confirms the profit maximization.

[15] See the appendix for derivation.

factor in the monopolist's profit in the Home currency. As a result, while a depreciation of a host country currency may decrease horizontal FDI into that country, a depreciation of a host country currency may increase vertical FDI into that country. This positive exchange rate effect on FDI is comparable to Froot and Stein (1991), Stevens (1993), Blonigen (1997) and Chen *et al.* (2006).

In summary, equations (11) and (16) show that the exchange rate has different effects on foreign direct investor's profit when engaging in different types of FDI. Equation (11) suggests that a depreciation of a host country currency may depress horizontal FDI into that country, whereas equation (16) suggests that a depreciation of a host country currency may promote vertical FDI into that country.

I.4. Expected Exchange Rate Effects on Different Types of FDI

This section extends the previous analysis to examine the effects of exchange rate expectations on different types of FDI. Like the exchange rate level, the expectations of exchange rate movements can also affect the allocations of FDI because the expectations affect the future profit of a foreign direct investor. More interestingly, the expectations of exchange rate movements can influence the relation between the exchange rate level and different types of FDI.

Suppose that the monopolist headquartered in Home wishes to make vertical FDI. Considering the positive exchange rate effect on vertical FDI, the monopolist may wait for a depreciation of the Foreign currency. However, if the monopolist expects the Foreign currency to depreciate further in the future, he needs to take

this future depreciation into an account because the future depreciation of the Foreign currency could increase his future profit. Provided that the future profit is larger than the profit generated by engaging in vertical FDI in the present, the monopolist will postpone vertical FDI until the future.

The justification easily applies to horizontal FDI as well. Suppose that the monopolist wishes to make horizontal FDI, and he expects the Foreign currency to depreciate further in the future. The monopolist would bring forward his horizontal FDI if the future depreciation of the Foreign currency reduces the monopolist's future profit to the extent that it is smaller than the profit generated by engaging in horizontal FDI in the present.

Evidently, the expectations of the exchange rate affect the exchange rate effects on FDI because a foreign direct investor can postpone or bring forward his FDI depending on his expectations of the exchange rate. Therefore, the exchange rate effects should be modified in light of the expectations of the exchange rate. This section develops foreign direct investors' timing of FDI associated with the expectations of exchange rate movements. It examines the relation between the effects of the exchange rate and the expectations of the exchange rate on different types of FDI. A simple two-period time frame is considered, and there is no uncertainty for simplicity.

I.4.1. Horizontal FDI

Suppose that the monopolist wishes to engage in horizontal FDI, and he needs to decide the time for engaging in the FDI. Since an investment decision can be analyzed by comparing profit of the investment (See Cushman (1985), Campa (1993), and Chen *et al.* (2006)), I will make use of the monopolist's intertemporal profit to determine the timing of the FDI.

If the monopolist engages in horizontal FDI, his profit is

$$\pi^H = \left(\frac{2}{\delta}\right)^{\frac{\delta}{\delta-2}} \left(\frac{2-\delta}{\delta}\right) \left(1 + e^{-1}(w^*)^{\frac{\delta}{\delta-2}}\right), \tag{17}$$

where π^H denotes the profit generated by engaging in horizontal FDI.[16] If not, the monopolist's profit is

$$\pi = \left(\frac{2}{\delta}\right)^{\frac{\delta-1}{\delta-2}} \left(1 + e^{\frac{1}{\delta-1}}\right)^{\frac{\delta-1}{\delta-2}} \left(\left(\frac{2}{\delta}\right)^{\frac{1}{\delta-2}} \left(1 + e^{\frac{1}{\delta-1}}\right)^{\frac{\delta-1}{\delta-2}} - \frac{\delta}{2}\right), \tag{18}$$

where π denotes the monopolist's profit without engaging in horizontal FDI. It is assumed that the monopolist exports final good Y to meet the Foreign demand without undertaking horizontal FDI.[17]

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[16] This is obtained by combining equations (8), (9) and (10). Preference parameter A is assumed to be 1 for simplicity.

[17] See the appendix for derivation.

Suppose now that there is a small one-time fixed cost associated with horizontal FDI.[18] The monopolist must pay the FDI cost in the Foreign currency at the time of engaging in FDI, and it is assumed to remain the same over the two periods. If the monopolist engages in horizontal FDI in the first period, the present discounted value of the monopolists' profit over the two periods is

$$\pi_1^H + \frac{1}{(1+r)}\pi_2^H - \frac{k^*}{e_1}, \tag{19}$$

where k^* is the fixed cost of the FDI in the Foreign currency, and r is the real interest rate. e_1 denotes the real exchange rate in the first period. Instead, if the monopolist engages in horizontal FDI in the second period, the present discounted value of the monopolists' profit over the two periods is

$$\pi_1 + \frac{1}{(1+r)}\pi_2^H - \frac{1}{(1+r)}\frac{k^*}{e_2} \tag{20}$$

When the latter (20) is greater than the former (19), the monopolist will engage in FDI in the second period rather than the first period. More explicitly, if equation (21) is true, the monopolist will make horizontal FDI in the second period because postponing FDI is more profitable.

[18] The fixed cost of FDI doesn't change the main results of the previous analysis because it doesn't affect the profit maximizing level of input and output.

$$(21) \qquad \left\{\pi_1^H + \frac{1}{(1+r)}\pi_2^H - \frac{k^*}{e_1}\right\} < \left\{\pi_1 + \frac{1}{(1+r)}\pi_2^H - \frac{1}{(1+r)}\frac{k^*}{e_2}\right\}$$

Substituting equations (17) and (18) into (21), the expected depreciation of the Foreign currency at which the monopolist will postpone horizontal FDI is solved for

$$(22) \qquad e_2 > \Omega_H^{-1},$$

where

$$\Omega_H = \frac{(1+r)}{k^*}\left\{\frac{k^*}{e_1} + \left(\frac{2}{\delta}\right)^{\frac{\delta-1}{\delta-2}}\left(1 + e_1^{\frac{1}{\delta-1}}\right)^{\frac{\delta-1}{\delta-2}}\left(\left(\frac{2}{\delta}\right)^{\frac{1}{\delta-2}}\left(1 + e_1^{\frac{1}{\delta-1}}\right)^{\frac{\delta-1}{\delta-2}} - \frac{\delta}{2}\right)\right.$$
$$\left. - \left(\frac{2}{\delta}\right)^{\frac{\delta}{\delta-2}}\left(\frac{2-\delta}{\delta}\right)\left(1 + e_1^{-1}(w^*)^{\frac{\delta}{\delta-2}}\right)\right\}$$

Equation (22) indicates that if the monopolist expects the Foreign currency to depreciate by more than Ω_H^{-1}, then he will postpone the horizontal FDI and engage in the FDI in the second period.

Nevertheless, it should be emphasized that not all the expected depreciation of the Foreign currency will lead to postponing horizontal FDI. If the monopolist expects the Foreign currency to depreciate by less than Ω_H^{-1} (but still depreciate), he would engage in FDI in the first period because postponing the FDI is not more profitable than making the FDI in the first period.

As a result, the effect of the expectations of the exchange rate on horizontal FDI depends on the monopolist's expectations of the exchange rate (above or below the threshold of Ω_H^{-1}), and the relation between the effect of the exchange rate and the expectations of the exchange rate on horizontal FDI also depend on the monopolist's expectations of the exchange rate. Specifically, when the expectation of the exchange rate is greater than the threshold of Ω_H^{-1}, this expectation effect may weaken the exchange rate effect on horizontal FDI because the monopolist could postpone horizontal FDI. On the other hand, when the expectation of the exchange rate is less than the threshold of Ω_H^{-1}, the expectation effect may strengthen the exchange rate effect on horizontal FDI because the monopolist could bring forward his horizontal FDI.[19]

In effect, the finding that there is a threshold level of depreciation of a host country currency at which a foreign direct investor would alter the timing of FDI is comparable to the study of Chakrabarti and Scholnick (2002). Chakrabarti and Scholnick suggest that a small shock and a large shock of the exchange rate may matter to FDI activity because a large shock affects foreign investors' expectations of the exchange rate differently from a small shock. To examine this hypothesis, they investigate FDI flows from the US to 20 OECD member countries, measuring an exchange rate shock by the skewness of exchange rate movements, and they find that a large depreciation of a host country currency may be positively correlated

[19] The effects of the expectations of the exchange rate on different types of FDI, and the dynamics between the effects of the exchange rate and the expectations of the exchange rate will be investigated more thoroughly in the third chapter.

with increases in FDI inflow to that country in the near future, but a small depreciation may not be as correlated with the FDI inflow in the near future as a large deprecation.

I.4.2. Vertical FDI

Suppose now that the monopolist wishes to engage in vertical FDI and needs to decide the time for engaging in FDI. As in the case of horizontal FDI, the monopolist's profit is evaluated first in order to determine the timing of vertical FDI. When the monopolist engages in vertical FDI, his profit is

$$\pi^V = \left(\frac{1-\delta}{\delta}\right)\left(\frac{2}{\delta}\left(1+\frac{w^*}{e}\right)\right)^{\frac{\delta}{\delta-2}}, \tag{23}$$

where π^V denotes the profit generated by engaging in vertical FDI.[20] If not, the monopolist's profit is[21]

$$\pi = \left(\frac{2-\delta}{2}\right)\left(\frac{4}{\delta}\right)^{\frac{\delta}{\delta-2}}, \tag{24}$$

[20] This is obtained by combining equations (14) and (15). Once again, preference parameter A is assumed to be 1 for simplicity.

[21] See the appendix for derivation.

where π denotes the monopolist's profit without engaging in vertical FDI, in which case intermediate input M is produced in Home. Using the same Cobb-Douglas production technology as in equation (12), the monopolist needs to employ twice as much Home labor as engaging in vertical FDI to produce the final good Y.[22]

Comparing the monopolist's intertemporal profits as in the case of horizontal FDI, the left hand side of equation (25) represents the present discounted value of the monopolists' profit over the two periods when the monopolist engages in vertical FDI in the first period, and the right hand side represents the present discounted value of the monopolists' profit over the two periods if vertical FDI is undertaken in the second period. k^* is a small one-time fixed cost involved with vertical FDI in the Foreign currency.

$$(25) \qquad \left\{\pi_1^V + \frac{1}{(1+r)}\pi_2^V - \frac{k^*}{e_1}\right\} < \left\{\pi_1 + \frac{1}{(1+r)}\pi_2^V - \frac{1}{(1+r)}\frac{k^*}{e_2}\right\}$$

If equation (25) holds, the monopolist will engage in vertical FDI in the second period.

Substituting equations (23) and (24) into (25), the expected depreciation of the Foreign currency at which the monopolist would postpone vertical FDI is solved as

$$(26) \qquad e_2 > \Omega_V^{-1},$$

[22] See the appendix for more.

where

$$\Omega_V = \frac{(1+r)}{k^*}\left\{\frac{k^*}{e_1} + \left(\frac{4}{\delta}\right)^{\frac{\delta}{\delta-2}}\left(\left(\frac{2-\delta}{2}\right) - \left(\frac{1-\delta}{2}\right)\left(\frac{1}{2} + \frac{w^*}{2e_1}\right)^{\frac{\delta}{\delta-2}}\right)\right\}$$

Equation (26) shows that if the monopolist expects the Foreign currency to depreciate by more than Ω_V^{-1}, he would postpone vertical FDI and engage in the FDI in the second period. Otherwise, the monopolist engages in vertical FDI in the first period. Therefore, the effect of the expectations of the exchange rate on vertical FDI depends on the monopolist's expectations of the exchange rate (above or below the threshold of Ω_V^{-1}), and the relation between the effects of the exchange rate and the expectations of the exchange rate on vertical FDI also depend on the monopolist's expectations of the exchange rate.

Even though the effect of the expectations of the exchange rate on vertical FDI is exactly the same as the effect on horizontal FDI, equations (22) and (26) reveal that the threshold for horizontal FDI is not the same as the threshold for vertical FDI. This implies that the same expectation of the exchange rate could have different effects on horizontal FDI and vertical FDI.

I.5. Conclusions

Motivated by mixed evidence for the exchange rate effects on FDI, this chapter examines how the exchange rate affects the allocation of different types of FDI. It suggests that the exchange rate effect on horizontal FDI may differ from the exchange rate effect on vertical FDI. It shows that while a depreciation of a host country currency may depress horizontal FDI into that country, a depreciation of a host country currency may promote vertical FDI into that country. This chapter also suggests that the exchange rate effects on different types of FDI are influenced by the expectations of the exchange rate movements because the expectations of the exchange rate affect foreign direct investors' timing of FDI. The analysis reveals that there is a threshold of the expected depreciation of a host country currency at which a foreign direct investor would alter the timing of FDI, and that the exact threshold for horizontal FDI and for vertical FDI differs.

Nevertheless, the model developed in this chapter is simple and future work will extend various features to increase realism. For example, capital is not included in the production technology. Given that capital is one of the most fundamental inputs, adding capital may alter the profit maximizing level of labor depending on the relationship between labor and capital (substitutes or complements). In the case of substitutes, the cost savings induced by a depreciation of a host country currency may be not as much as that considered in the model. Therefore, it would be interesting to see how the exchange rate effects may vary with capital as an additional input.

Likewise, production technology would influence the exchange rate effects on different types of FDI because different production technologies may drastically change the profit maximizing level of labor through labor productivity. Particularly, the production technology associated with horizontal FDI and vertical FDI (equation (7) and (12), respectively) will bring an interesting intricacy to the exchange rate effects on different types of FDI.

Moreover, a more developed dynamic model will certainly help to examine the effect of exchange rate expectations on different types of FDI and the relation between the effects of the exchange rate and the expectations of the exchange rate on different types of FDI, clarifying the threshold for horizontal FDI and for vertical FDI.

CHAPTER II

THE EXCHANGE RATE EFFECTS ON THE DIFFERENT TYPES OF FOREIGN DIRECT INVESTMENT: EMPIRICAL EVIDENCE

II.1. Introduction

Motivated by mixed evidence for the exchange rate effects on FDI, the first chapter examined how the exchange rate affects the allocation of FDI in terms of different types of FDI. Extending the model of Aizenman and Marion (2004), the first chapter demonstrated that a depreciation of a host country currency is correlated with a decrease in horizontal FDI into that country, while a depreciation of a host country currency is correlated with an increase in vertical FDI into that country.

This second chapter empirically examines how the exchange rate affects the allocation of different types of FDI. To test the exchange rate effects on different types of FDI, it is imperative to differentiate horizontal FDI from vertical FDI. Thus, allowing for the general attributes of horizontal FDI and vertical FDI, I settle on four different measures of horizontal FDI and of vertical FDI (See section II.4), and these four measures are applied to dividing FDI into horizontal FDI and vertical FDI. The original FDI data, before the separation, come from Thompson financial M&A data set. One reason to use this data set is to reflect the recent trend that FDI has been made in the form of M&A (see section II.2.1), but a more important reason is that the

data set is quite disaggregated, allowing one to measure horizontal FDI and vertical FDI more accurately according to the four different measures of horizontal FDI and vertical FDI.

With those measures of horizontal FDI and vertical FDI, I construct a directional country pair (a host country and a home country as a pair) to control for unobserved country specific characteristics that might affect FDI activity. Then, the exchange rate effect on horizontal FDI and vertical FDI is estimated by a Poisson regression with fixed and random effects, as well as by a negative binomial regression with fixed and random effects.

The estimation results provide significant support for the model's prediction in the first chapter. The exchange rate effect on horizontal FDI is indeed different from vertical FDI. While a deprecation of a host country currency depresses horizontal FDI into that country, a depreciation of a host country promotes vertical FDI into that country. Although the results do not show as much evidence for the exchange rate effect on vertical FDI as horizontal FDI, an additional analysis reveals that a more careful measure of vertical FDI provides stronger evidence for the exchange rate effect on vertical FDI.

A comparable study is found in Chen *et al.* (2006).[23] The authors divide FDI into market-oriented FDI and cost-oriented FDI by means of different motives behind the FDI decisions. Although market-oriented FDI is similar to horizontal FDI and cost-oriented FDI is similar to vertical FDI, both horizontal FDI and vertical FDI

[23] See the first chapter for a review of their study.

can be cost-oriented FDI because horizontal FDI also involves cost savings. In fact, the authors state that cost-oriented FDI in their sample is horizontal FDI or vertical FDI. I, on the other hand, focus on different types of FDI. Of course, how to measure different types of FDI differ from their way of measuring different motives of FDI, but their study clearly supports the estimation results in this chapter.[24]

This chapter is organized as follows. The next section presents the empirical specification to estimate the exchange rate effects on different types of FDI. Section 3 describes the data. Section 4 discusses the various measures of horizontal FDI and vertical FDI. Section 5 puts forward the expected sign of the exchange rate effect on different types of FDI, and section 6 presents the estimation results. The last section concludes with suggestions for future work.

II.2. Estimation

The theoretical model in the first chapter reveals important determinants of the allocation of different types of FDI. It suggests that the exchange rate, the relative real wage of a host country and a home country, and consumer preferences in a host country and a home country are significant factors affecting the allocation.[25] Accordingly, the following specification is proposed to estimate the exchange rate effect on different types of FDI:

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[24] The authors use industry sales and reverse-import of an industry to measure different motives of FDI. I use to what extent a country is industrialized and SIC codes to measure different types of FDI.

[25] The theoretical model in the first chapter endogenized the profit maximizing level of output and labor.

$$(1) \qquad FDI\ activity = f\begin{pmatrix} exchange\ rate, \\ relative\ real\ wage, \\ other\ controls \end{pmatrix}$$

The dependent variable of FDI activity is explained by the exchange rate, the relative real wage of a host and a home country, and other explanatory variables including year dummies to control for time-related aggregate effects on FDI activity. Moreover, country pair fixed effects estimation is applied to control for unobserved country specific characteristics and time-constant factors that might have affected FDI activity. Provided that consumer preferences don't change over time, the country pair fixed effects will control for consumer preference differences in a host country and a home country. The next subsections discuss the variables and estimation method in detail.

II.2.1. Dependent Variable

The dependent variable of FDI activity is measured by the *number* of M&A that took place in a host country from home countries in a year, using Thomson's M&A data. However, two issues need to be resolved in order to use this measure. First, I need to address whether M&A correctly reflects FDI activity and, second, whether FDI activity is correctly measured by count data.

First, I use M&A to measure FDI activity. Although M&A is one of the methods of establishing FDI, M&A seems to be the most preferred form of FDI.[26] Most of FDI activity is in the form of M&A, and the volume of M&A in FDI has steadily increased. For example, Aguiar and Gopinath (2005) report that over 70% of FDI inflow to Asia in 1990's was made in the form of M&A.

Graphs 2.1 and 2.2 show a relationship between M&A (count data) and FDI (flow data in *real* terms) from 1985 to 2007 for the 7 most industrialized countries and 7 industrializing countries that have been active participants in FDI (See section II.3 for M&A and FDI data).[27] Graph 2.1 plots inward M&A (M&A inflow to a country) and inward FDI (FDI inflow to a country) of each country, and graph 2.2 plots outward M&A (M&A outflow from a country) and outward FDI (FDI outflow from a country) of each country.

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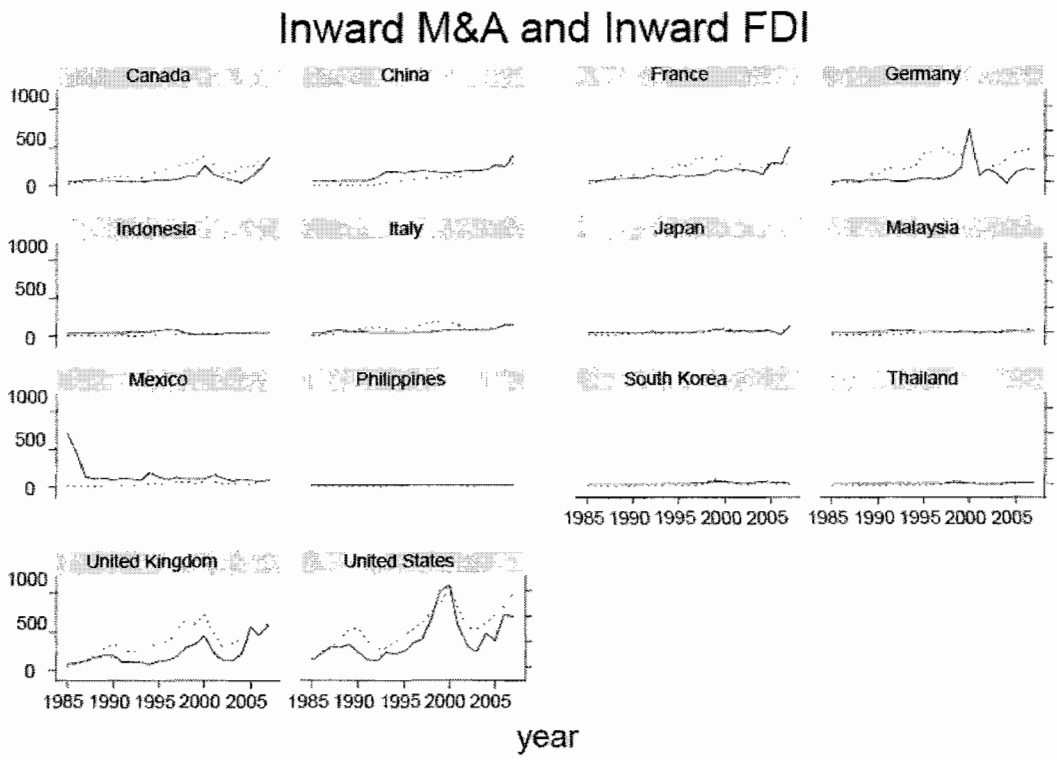
[26] FDI can take a form of subsidiary, joint venture, M&A, green-field investment, licensing agreement and so on. No matter which form it takes, the parent firm must have *control* over its foreign affiliate in order for its foreign investment to be qualified as direct investment.

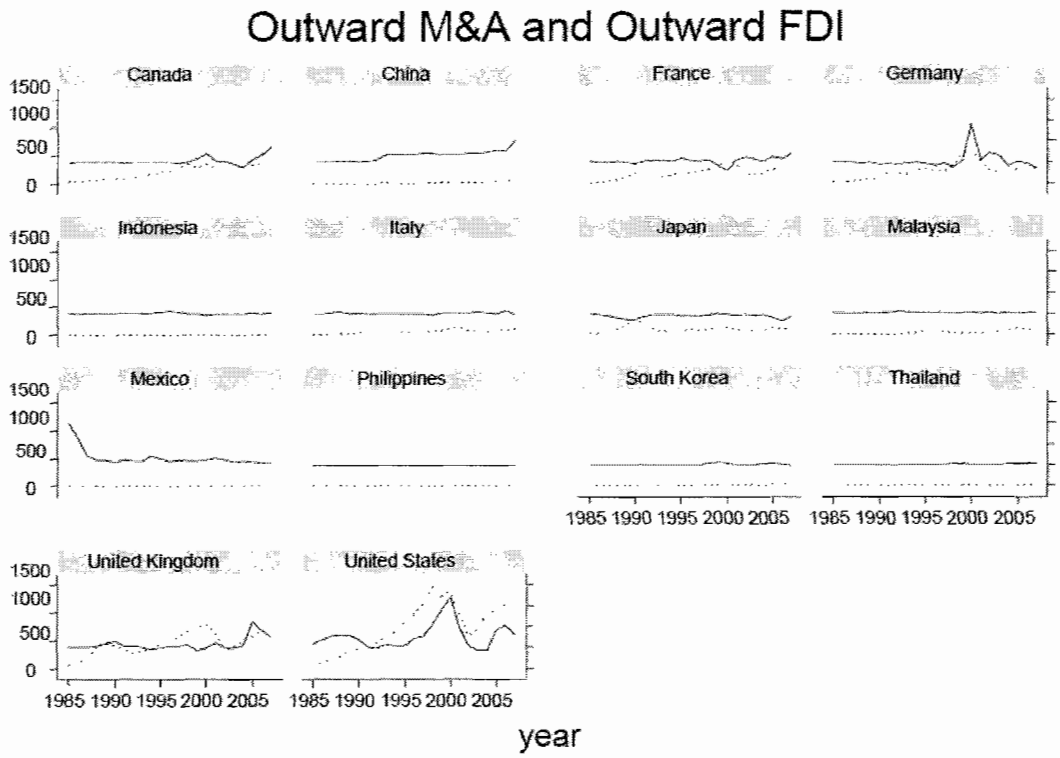
[27] The 7 most industrialized countries are Canada, France, Germany, Italy, Japan, the United Kingdom and the United States; 7 industrializing countries are China, Indonesia, Malaysia, Mexico, Philippines, South Korea, and Thailand.

Graph 2.1. Relationship between Inward M&A (dot line) and Inward FDI (solid line).



Source: M&A count data are constructed from the M&A data taken from Thomson Financial Securities Data Corporation. FDI flow data are computed using the World Development Indicator. See section II.3 for more.

Graph 2.2. Relationship between Outward M&A (dot line) and Outward FDI (solid line).



Source: M&A count data are constructed from M&A data taken from Thomson Financial Securities Data Corporation. FDI flow data are computed using the World Development Indicator. See section II.3 for more.

As seen, inward M&A shows a very close relation to inward FDI. Especially the U.S., the U.K., Canada and South Korea show great similarity between inward M&A and inward FDI. Outward M&A and outward FDI also appears to share a close relationship to some extent.

Table 2.1. Correlation between M&A and FDI for the 7 Most Industrialized Countries.

	Canada	France	Germany	Italy	Japan	UK	US
Inward	0.78*	0.49*	0.40	0.26	0.56*	0.76*	0.89*
Outward	0.49*	−0.15	0.53*	0.15	−0.56*	0.35	0.57*

* indicates statistical significance at the 5% level.

Table 2.2. Correlation between M&A and FDI for 7 Industrializing Countries.

	China	Indonesia	Malaysia	Mexico	Philippines	S. Korea	Thailand
Inward	0.89*	−0.13	0.34	−0.43*	0.36	0.90*	0.82*
Outward	0.93*	0.67*	0.05	−0.42*	0.04	−0.2	0.41*

* indicates statistical significance at the 5% level.

In effect, statistical correlations in tables 2.1 and 2.2 reveal a very interesting pattern. The correlation between M&A and FDI is higher for inward activity than for outward activity. Canada, China, South Korea, the U.K. and the U.S. show a statistically significant and relatively high correlation between inward M&A and inward FDI, but these countries (except China) do not show the same degree of correlation between outward M&A and outward FDI. Similarly while Japan shows a statistically significant, positive correlation between inward M&A and inward FDI, it

shows a statistically significant, negative correlation between outward M&A and outward FDI.

Therefore, two things are very clear from the graphs and the statistical correlations. First, inward M&A reflects overall FDI activity more correctly than outward M&A over the period of 1985 to 2007. Head and Ries (2008) argue that M&A reflects FDI activity reasonably well for OECD member countries. Second, each country exhibits a different pattern of M&A and FDI. Given these two observations, the use of inward M&A will be more precise in measuring FDI, and it seems to be of great importance having control for country specific factors affecting FDI activity, such as geographical and cultural proximity.

Regarding the second issue of whether FDI activity is correctly measured by count data, admittedly, there is a concern of heterogeneity across investment if M&A is counted.[28] I could measure M&A in monetary units, instead of counting, but more than 55% of the monetary value of M&A in the sample, Thomson's M&A data set, is missing (See section II.3 for more). These missing data make it very difficult to analyze M&A patterns accurately. As a result, I am forced to use M&A count data. But, again, M&A count data reflect FDI flow data reasonably well as graphs 2.1 and 2.2 show. Besides, investment inherently involves a decision of whether to make or not to make. If so, an investment decision can be treated as an entry decision (whether to enter or not to enter), as in Campa (1993) and Chen *et al.*, (2006). Thus, if M&A is

[28] Testing the exchange rate effects on different types of FDI, using FDI flow data, remains as further research.

treated as entry of a foreign direct investor to a host country, counting M&A may be a reasonable measure of FDI activity after all.

Above all, there is a great advantage of using Thomson's M&A data as the sample because they are sufficiently disaggregated to allow dividing FDI more accurately into horizontal FDI and vertical FDI (see section II.4). These various measures of horizontal FDI and vertical FDI will help to estimate the exchange rate effects on different types of FDI with more precision. The next sections explain the explanatory variables, the estimation methods, the data, and the measures of different types of FDI.

II.2.2. Explanatory Variables

Annual *bilateral* real exchange rates are used as the measure of the exchange rate. The bilateral real exchange rates were computed based on the official annual exchange rate of a host country and a home country. The official exchange rate of each country is the nominal exchange rate, so that the real exchange rate is computed by deflating the official exchange by the GDP deflator of each country. The real exchange rate is expressed as a host country currency *per* one unit of the home country currency in real terms.

Then, the annual real exchange rate is normalized by dividing the exchange rate by the exchange rate in 1985, so that the exchange rate in 1985 is set to be 1.[29]

[29] This is because the sample period is from 1985 to 2007. For Czech Republic, however, its exchange rate in 1993 is set to be 1 because the exchange rates from 1985 to 1992 are unavailable.

This normalization makes the exchange rate unit free.[30] Finally, the normalized exchange rate is lagged by one year because the FDI decision takes some time. That is, FDI made this year may be more related to the exchange rate movements in the previous year than in this year because the actual decision on the FDI might be made prior to this year.[31] In a nutshell, the exchange rate will refer to the unit-free exchange rate lagged by one year.

The real wage is measured by dividing real GDP by the number of the employed, applying a rough approximation that the real wage is equal to labor productivity. Although the approximation is debatable, it is drawn on because it is very difficult to collect wages for all 37 sample countries over the sample period from 1985 to 2007. In fact, the approximation is reasonable given evidence that the real wage and labor productivity tend to move together.[32]

In computing labor productivity, I use real gross domestic product (GDP) based on purchasing power parity (PPP). GDP based on PPP is deliberately chosen because of the concern of high collinearity with exchange rate movements. For example, when a foreign county's GDP is converted to U.S. dollars for the purpose of a common measure, the official exchange rate must be used. Then, the converted GDP necessarily mirrors the movements of the foreign country's exchange rate. This

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[30] The real exchange rate is not yet in unit-free terms because it is price *index* that is used in deflating the nominal exchange rate.

[31] See Chakrabarti and Scholnick (2002) and Chen *et al,* (2006) as example of studies that have used one year lagged exchange rate.

[32] Feldstein (2008) argues that labor productivity tends to move together with the real wage. More so with total real compensation, when total compensation is deflated by the same price index that is used in calculating labor productivity. See Feldstein (2008) for more.

will cause a high correlation between the foreign country's exchange rate and the converted foreign country's GDP. Therefore, GDP based on PPP that is converted to constant 2005 international dollars is used in measuring the real GDP in each country.

After computing the real wage by dividing the real GDP by the number of the employed for each country, the *relative* real wage is constructed by dividing the real wage in a host country by the real wage in a home country. This relative real wage is also lagged one year because of the time-consuming FDI decision.

In estimating the exchange rate effects on different types of FDI, panel estimation method is used.[33] Thus, time-*constant* factors are controlled for by fixed effects or random effects. More specifically, country pair fixed effects estimation is used to control for unobserved country specific characteristics and other time-constant factors—geographical and cultural proximity, for example—that might be related to FDI activity and the explanatory variables. Assuming consumer preferences do not change over time, country pair fixed effects also control for consumer preferences in a host country and a home country (see section II.3 for country pairs).

In addition to fixed effects, random effects are alternatively examined. A Hausman test is applied to evaluate whether fixed or random effects are preferred. Also, I have included year dummies in order to control for time-*specific* factors,

[33] This is tested by a likelihood ratio test. See appendix for the test results.

other than the explanatory variables, that might have affected FDI activity over the sample period from 1985 to 2007.

A Poisson regression may be appropriate given the (nonnegative) count dependent variable. However, simple summary statistics reveal that the variance of the dependent variable is much larger than the mean (see the fourth row in table 2.3). To accommodate this over-dispersion in the dependent variable, a negative binomial regression is also considered. Consequently, a negative binominal regression with fixed and random effects and a Poisson regression with fixed and random effects, are used to examine the exchange rate effects on different types of FDI. Moreover, a likelihood test and α-statistics are used to select between a negative binominal regression and a Poisson regression.[34]

II.2.3. Distribution

This section briefly reviews the statistical estimation method used in the analysis. A negative binomial regression assumes that the dependent variable has a negative binomial distribution (see Greene (2008) for more). The probability density function is given by

$$(2) \qquad Prob(Y_{it} = y_{it}|X_{it}) = \frac{\Gamma(\theta + y_{it})}{\Gamma(y_{it}+1)\Gamma(\theta)} r_{it}^{y_{it}}(1 - r_{it})^{\theta},$$
$$\text{where } r_{it} = \lambda_{it}/(\lambda_{it} + \theta)\,.$$

[34] See the appendix for the test results and α-statistics.

Y_{it}, the dependent variable, is the count variable for the M&A that took place between matched country pair i in year t, and X_{it} is the vector of the suggested explanatory variables (see equation (1)) for the country pair i in year t.

The negative binomial distribution has conditional mean, λ_{it}, and conditional variance, $\lambda_{it}(1 + (1/\theta)\lambda_{it})$, where θ is a parameter for the distribution. As a convention, the mean of the (nonnegative) count dependent variable, λ_{it}, is parameterized by the exponential function of the explanatory variables (X_{it}) and the coefficient vector (β):

$$\lambda_{it} = exp(X'_{it}\beta) \tag{3}$$

Then, the coefficient vector, β, is estimated by the method of maximum likelihood estimation with fixed and random effects in this chapter (see Greene (2008) for more).

Interestingly, when $(1/\theta) = 0$, the variance is equal to the mean. That is, the negative binomial distribution becomes a Poisson distribution with mean of λ_{it}. Because of this, $1/\theta$ is the basis for α-statistics that discriminates between a negative binomial regression model and a Poisson regression model.[35] In the case of $(1/\theta) = 0$, a Poisson regression model estimates the coefficient vector (β) with fixed and random effects.

[35] α-statistics indicates that a Poisson regression is preferred to a negative binomial regression when $\alpha = (1/\theta)$ is not significantly different from zero.

II.3. Data

The constructed data is a panel data of matched pairs of host country and home country combinations over the years from 1985 to 2007. The dependent variable is FDI activity measured by the number of M&A that took place in a host country from home countries in a year. In order to count the number of M&A, a matched country pair is constructed from *directional* M&A in sense that the number of M&A counts M&A inflow to a country (host country) from other countries (home countries).

However, a country pair, itself, does not single out inward M&A (M&A inflow to a country) or outward M&A (M&A outflow from a country). In order to divide M&A into inward M&A or outward M&A, the matched country pairs must be sorted out. Sorting the country pairs by a *host* country will separate out *inward* M&A and sorting country pairs by a *home* country will separate out *outward* M&A. As pointed out earlier, inward M&A should be used to measure FDI activity (See section II.2.1). Thus, in measuring FDI activity, the matched country pairs are regrouped according to a host country.

By putting a host country and a home country in a pair, 1065 matched country pairs have been constructed. Table 2.3 reveals the summary statistics of the matched country pairs over the entire sample.[36] 'Pairs' shows that there are 1065 matched country pairs in the entire sample, and the sample period is from 1985 to

[36] Sub-samples are considered for the various measures of horizontal FDI and vertical FDI (See the next section).

2007. 'M&A' shows that the number of M&A ranges from 0 to 398.[37] The mean and the standard deviation of 'M&A' present the over-dispersion in the variable.

Table 2.3. Summary Statistics of Country Pairs Using the Entire Sample.

Variables	Obs.	Mean	Std. Dev.	Min	Max
Pairs	23483	·	·	1	1065
Year	23483	·	·	1985	2007
M&A	23483	2.937	12.644	0	398

The M&A data come from Thomson Financial Securities Data Corporation that collects information on mergers and acquisitions (M&A). The data set kept track of all the M&A that took place among more than 210 countries from year 1985 to year 2007, and consist of 401,830 observations over that period. Moreover, the data set provides detailed information on host countries and home countries; a parent firm and its foreign affiliate; the SIC (Standard Industrial Classification) code of the parent firm and its foreign affiliate; the percentage of shares acquired; and the date of M&A and the monetary value of M&A. There is a relatively small amount of missing values except the monetary value of M&A. More than 55% of the monetary value is missing.

Out of the entire M&A data, I focus only on cross border M&A because my primary interest is the activity of foreign investment, not domestic investment. So, cross border M&As are chosen by selecting a host country and a home country that are different from each other. Among these cross border M&A, I need to choose

[37] In 1998 there were 398 M&As into the U.K. from the U.S.

direct investment, not all investment. Accordingly, I select M&A that involves 10 percent or more voting share because by definition, direct investment involves 10 percent or more voting stocks. After these selections, 312,246 observations are dropped from the original data set, and now the data set consists of 89,584 observations with 216 host countries and 172 home countries.

Further, I focus on OECD member countries plus industrializing Asian countries because of the unavailability of the exchange rate of other countries over the entire sample period. Besides, considering that M&A reflects FDI activity reasonably well for OECD member countries, focusing on OECD member countries would be better for measuring FDI activity. With this concentration, the final sample includes 69,474 observations with 37 host countries and 37 home countries.[38]

The data on all of the explanatory variables including FDI data in section II.2.1 have been collected from the World Development Indicator (WDI) database. Although the WDI provides very a rich data set, I was not able to collect all the wage data for the sample countries. Alternatively, I have constructed the relative real wages, and the constructed wages are based on the WDI data set.

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[38] The countries are Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland-Rep, Italy, Japan, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Singapore, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

II.4. Measures of Horizontal FDI and Vertical FDI

In order to estimate the exchange rate effects on different types of FDI, it is very important how horizontal FDI and vertical FDI are measured. However, it is not easy to divide FDI into horizontal FDI and vertical FDI because most of FDI database reports FDI data in aggregate forms such as FDI inflows and outflows.[39] However, Thomson's M&A data are disaggregated enough that it allows measuring horizontal FDI and vertical FDI more accurately.

Table 2.4 shows the various measures of horizontal FDI and vertical FDI. The first measure of horizontal FDI and vertical FDI is motivated by the observation that industrialized countries tend to host horizontal FDI, while industrializing countries tend to host vertical FDI (see Aizenman and Marion (2004); Hanson et al. (2005); Glass (2008) and Markusen and Maskus (2001)). Following this observation, the first measure of horizontal FDI is taken by M&A inflow to the 7 most industrialized countries: Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.[40] Likewise, the first measure of vertical FDI is taken by M&A inflow to the 7 industrializing countries: China, Indonesia, Malaysia, Mexico, Philippines, South Korea, and Thailand.[41]

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[39] The FDI statistics by UNCTAD, WDI, IMF and OECD all report FDI data in aggregate forms. UNCTAD and OECD report FDI data by industry and by region, but they are not disaggregated to the extent that Thomson's M&A data are.

[40] As discussed in the data section, this is done by sorting the matched country pairs by the 7 most industrialized countries as being a host country.

[41] This is constructed by sorting the matched country pairs by the 7 industrializing countries as being a host country.

Table 2.4. Measure of Horizontal FDI and Vertical FDI.

Measure	Horizontal FDI	Vertical FDI
1	Into industrialized countries	Into industrializing countries
2	Same SIC code	Different SIC code
3	1 and 2	1 and 2
4	Into industrialized countries from industrialized countries only	Into industrializing countries from industrialized countries only

Note: The 7 most industrialized countries are Canada, France, Germany, Italy, Japan, the United Kingdom and the United States; 7 industrializing countries are China, Indonesia, Malaysia, Mexico, Philippines, South Korea, and Thailand.

The second measure is chosen according to an implication of horizontal FDI and vertical FDI. While horizontal FDI means that a foreign direct investor is operating in the same industry abroad as that where he operates in his own country, vertical FDI implies that a foreign direct investor is operating in associated industries abroad in line with its production stages in his own country (see the first chapter for more). Based on this implication, horizontal FDI is measured by M&A of which the acquirer and the acquiring are in the same industry (i.e., the same SIC code), and in contrast, vertical FDI is measured by M&A of which the acquirer and the acquiring are in different industries (i.e., different SIC code).

The third measure combines the first and second measure. Specifically, the third measure of horizontal FDI is taken by M&A inflow to the 7 most industrialized countries of which the acquirer and the acquiring are in the same industry. In the same way, the third measure of vertical FDI is measured by M&A inflow to the 7 industrializing countries of which the acquirer and the acquiring are in different industries.

Finally, the fourth measure of horizontal FDI and vertical FDI is taken by reducing the number of home countries. This measure of horizontal FDI and vertical FDI is essentially the same as the first measure of horizontal FDI and the vertical FDI. But the fourth measure considers M&A made only from the 7 most industrialized countries. That is, horizontal FDI is measured by M&A among the 7 most industrialized countries (i.e., among industrialized countries), and vertical FDI is measured by M&A inflow to the 7 industrializing countries from the 7 most industrialized countries (i.e., to industrializing countries from industrialized countries). This measure of horizontal FDI and vertical FDI is also supported by other studies (see Aizenman and Marion (2004); Glass (2008) and Markusen and Maskus (2001)).

Moreover, the fourth measure of horizontal FDI and vertical FDI serves one more purpose. It is well known that a negative binomial regression does a better job without too many zero counts. However, around 61% of FDI activity in the entire sample is zero account. 51 % of the first measure of horizontal FDI and 70% of the first measure of vertical FDI are zero accounts. Also, over 60% of horizontal FDI and vertical FDI measured by the second and third measure are zero counts.[42] But, the zero accounts in the fourth measure are reduced to 12% for horizontal FDI and 50% for vertical FDI. Interestingly, the empirical results under the fourth measure show

[42] More specifically, 71% of the second measure of horizontal FDI and 64% of the second measure of vertical FDI are zero accounts. And, 60% of the third measure of horizontal FDI and 73% of the third measure of vertical FDI are zero accounts.

solid support for the exchange rate effects on horizontal FDI, but not so much for vertical FDI (See section II.6 for more).

II.5. Expected Sign of Explanatory Variables

The theoretical model in the first chapter hypothesizes that while a depreciation of a host country currency is correlated with a decrease in horizontal FDI into that country, a depreciation of a host country currency is correlated with an increase in vertical FDI into that country. As a result, the expected sign of the exchange rate is *negative* for horizontal FDI, and the expected sign is *positive* for vertical FDI.

Table 2.5. Expected Sign of Explanatory Variable.

FDI	Explanatory Variables	
	ER	Rel. Wage
Horizontal	−	−
Vertical	+	−

Moreover, the model also predicts that the relative real wage is correlated with a decrease in both horizontal FDI and vertical FDI.[43] The negative correlation implies that relatively high wage in a host country will reduce foreign direct investor's profit, so that both types of FDI are less likely to occur (see Campa (1993), Chen *et al.* (2006), Hanson et al, (2005), Jeon and Rhee (2008)). Therefore, the expected sign of the relative real wage for both horizontal FDI and vertical FDI is

[43] See equations (8) and (14) in the first chapter.

negative. Table 2.5 provides the expected sign of the exchange rate (ER) and the relative real wage (Rel. Wage).

As mentioned earlier, one closely related study is Chen *et al.* (2006). Dividing FDI into market-oriented FDI and cost-oriented FDI, the authors show a negative effect of the exchange rate on market-oriented FDI, which is similar to horizontal FDI, but a positive effect on cost-oriented FDI, which is similar to vertical FDI. The next sections give details on the empirical results of the analysis.

II.6. Estimation Results

A Poisson regression model with fixed and random effects, and a negative binominal regression model with fixed and random effects are used to examine the exchange rate effects on different types of FDI. In order to evaluate each estimation method, several tests are in place. First, the likelihood ratio test of discriminating between a pooled regression model and a panel regression model indicates that a panel regression model is preferred for every single regression that has been estimated. In effect, this is not really surprising given the patterns of M&A observed in graphs 2.1 and 2.2.

Second, the likelihood ratio test of discerning between a negative binomial regression model and a Poisson regression model suggests that a negative binomial regression model is preferred for all the estimated regressions. Moreover, α-statistics also confirms that a negative binomial regression model is preferred. The estimation results are reported in the following.

II.6.1. Horizontal FDI

Table 2.6 shows the empirical results on the various measures of horizontal FDI.[44] The negative binomial regression model reveals that the exchange rate (ER) effect on the horizontal FDI measured by all the measures of horizontal FDI (see table 2.4) is negative and statistically very significant. These provide strong evidence supporting the model's prediction in the first chapter that a depreciation of a host country currency is correlated with a decrease in horizontal FDI. The coefficient (-0.244) of the exchange rate under the first measure of horizontal FDI measures that 10% increase in the exchange rate would reduces horizontal FDI by around 1.4%. Under third measure, the coefficient (-0.597) measures that 10% increase in the exchange rate would reduces horizontal FDI by about 3.5%.

Moreover, the relative real wage (Rel. Wage) effect on horizontal FDI measured by all the measures of horizontal FDI is negative and statistically very significant. There are consistent with the model's prediction in the first chapter that a relatively high real wage in a host country is correlated with a decrease in horizontal FDI. Therefore, the empirical results provide strong evidence for the exchange rate effect and the relative real wage effect on horizontal FDI.

[44] The coefficients of year dummies are not reported in the table. See the appendix for the complete estimation results.

Table 2.6. The Exchange Rate Effect on Horizontal FDI.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	-0.244**	-0.241**	-0.482***	-0.478***
	(0.076)	(0.075)	(0.042)	(0.041)
Rel. Wage	-0.076***	-0.101***	-0.085***	-0.114***
	(0.018)	(0.016)	(0.020)	(0.018)
Number of Obs.	4443	4482	4443	4482
Measured by (2)				
ER	-0.248***	-0.293***	-0.197***	-0.237***
	(0.068)	(0.062)	(0.055)	(0.051)
Rel. Wage	-0.050*	-0.070***	-0.043	-0.063***
	(0.020)	(0.015)	(0.022)	(0.016)
Number of Obs.	15019	15309	15019	15309
Measured by (3)				
ER	-0.597***	-0.586***	-0.489***	-0.492***
	(0.117)	(0.113)	(0.082)	(0.080)
Rel. Wage	-0.086**	-0.124***	-0.093*	-0.134***
	(0.030)	(0.024)	(0.039)	(0.026)
Number of Obs.	3819	3880	3819	3880
Measured by (4)				
ER	-0.516***	-0.513***	-0.595***	-0.592***
	(0.107)	(0.106)	(0.050)	(0.049)
Rel. Wage	-0.879**	-0.781*	0.119	0.151
	(0.334)	(0.328)	(0.200)	(0.196)
Number of Obs.	852	852	852	852
Before Discriminating Between Horizontal FDI and Vertical FDI				
ER	-0.111*	-0.139**	-0.196***	-0.204***
	(0.045)	(0.043)	(0.029)	(0.029)
Rel. Wage	-0.035**	-0.065***	-0.055***	-0.078***
	(0.012)	(0.010)	(0.012)	(0.011)
Number of Obs.	18486	18765	18486	18765

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

Although the Poisson regression model provides similar results, the likelihood ratio test and α-statistics indicate that the negative binomial regression model is more appropriate than the Poisson regression model (see the appendix for the complete estimation results including the likelihood ratio test and α-statistics).

Additionally, the negative binomial regression model based on the overall FDI (i.e., FDI before differentiating horizontal FDI from vertical FDI) reveals the exact same patterns as the results based on the various measures of horizontal FDI (see the bottom part of the table). The exchange rate effect on overall FDI is negative and statistically very significant, and this negative exchange rate effect on FDI is consistent with Campa (1993), Chakrabarti and Scholnick (2002), and Chen *et al.* (2006). The relative real wage effect on overall FDI is also negative and statistically significant. This is consistent with Campa (1993), Chen *et al.* (2006), Hanson et al, (2005), and Jeon and Rhee (2008).

II.6.2. Vertical FDI

Table 2.7 reports the estimation results on the various measures of vertical FDI. Favored by the likelihood ratio test and α-statistics, the negative binomial regression model reveals that the exchange rate effect on vertical FDI is statistically insignificant under all of the measures of vertical FDI. Although the random effects under the second measure of vertical FDI show the exchange rate effect is statistically significant at the 5% level, a Hausman test indicates that the fixed effects are preferred.

Furthermore, a negative exchange rate effect on vertical FDI is observed. Even if it is not statistically significant, the negative effect is directly against the model's prediction in the first chapter. This unexpected result is quite puzzling. Perhaps the measures of vertical FDI might not be an accurate measure of vertical

FDI. Or, M&A inflow might not reflect vertical FDI accurately. Either way, this result asks for a more careful measure of vertical FDI: An alternative measure of vertical FDI will be considered later on (see table 2.8).

Table 2.7. The Exchange Rate Effect on Vertical FDI.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.006	-0.039	0.01	-0.015
	(0.086)	(0.082)	(0.069)	(0.066)
Rel. Wage	-0.186	-0.279***	0.254	-0.280**
	(0.158)	(0.084)	(0.185)	(0.103)
Number of Obs.	3089	3203	3089	3203
Measured by (2)				
ER	-0.074	-0.107*	-0.179***	-0.186***
	(0.050)	(0.048)	(0.035)	(0.033)
Rel. Wage	-0.031*	-0.065***	-0.042**	-0.071***
	(0.013)	(0.011)	(0.013)	(0.012)
Number of Obs.	17368	17663	17368	17663
Measured by (3)				
ER	0.037	-0.021	0.089	0.058
	(0.102)	(0.095)	(0.084)	(0.078)
Rel. Wage	0.052	-0.202*	0.365†	-0.213†
	(0.240)	(0.098)	(0.212)	(0.123)
Number of Obs.	2830	2968	2830	2968
Measured by (4)				
ER	0.147	0.08	0.264*	0.236*
	(0.125)	(0.121)	(0.105)	(0.101)
Rel. Wage	1.765**	1.265*	5.748***	3.738***
	(0.662)	(0.546)	(0.883)	(0.747)
Number of Obs.	877	877	877	877
Before Discriminating Between Horizontal FDI and Vertical FDI				
ER	-0.111*	-0.139**	-0.196***	-0.204***
	(0.045)	(0.043)	(0.029)	(0.029)
Rel. Wage	-0.035**	-0.065***	-0.055***	-0.078***
	(0.012)	(0.010)	(0.012)	(0.011)
Number of Obs.	18486	18765	18486	18765

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The relative real wage effect on vertical FDI measured by all the measures of vertical FDI is negative, except for the fourth measure of vertical FDI. Although there are inconsistent wage effects under the third measure of vertical FDI, a Hausman test prefers the random effects, so that the wage effect is negative and statistically significant at the 5% level. The wage effect under the first measure of vertical FDI is statistically indeterminate since a Hausman test is unable to tell between the fixed effects and the random effects, but the wage effect is correctly negative, as expected. Moreover, the negative wage effect under the second and third measure of vertical FDI are statistically significant at the 5% level. These may provide sound evidence for the relative real wage effect on vertical FDI. Nevertheless, the wage effect under the fourth measure is positive and even statistically significant. This unexpected result may also call for a more accurate measure of vertical FDI.

Accordingly, while the empirical results do not show much support for the exchange rate effect on vertical FDI, the negative real wage effect on vertical FDI is in favor of the model's prediction. The lack of evidence for the exchange rate effect may call for a more careful measure of vertical FDI once again.

As pointed out in this section, the lack of evidence for the exchange rate effect on vertical FDI may demand a more accurate measure of vertical FDI. Thus, I construct an alternative measure of vertical FDI to search for more evidence of the exchange rate effect on vertical FDI. An alternative measure of vertical FDI is considered by means of excluding Indonesia, Malaysia and Philippines from the host countries of the first measure of vertical FDI. This is because these countries have

the weakest link between M&A inflow and FDI inflow (see table 2.2). Table 2.8 summarizes the estimation results.

Preferred by the likelihood ratio test and α-statistics, the negative binomial regression model shows that the sign of each explanatory variable is indeed consistent with the model's prediction. The exchange rate effect on vertical FDI is correctly positive, as expected, and even statistically significant at the 10% level. The coefficient (0.188) of the exchange rate measures that 10% increase in the exchange rate would increase vertical FDI by about 14%. Note that the 10% significance level is equivalent to the 5% significance level of a one-tailed test.[45] Moreover, a one-tailed test can be well justified given the alternative hypothesis that a depreciation of a host country currency is correlated with an increase in vertical FDI.

Table 2.8. The Exchange Rate Effect on Vertical FDI, Measured by (1) and by Excluding Indonesia, Malaysia and Philippines.

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.229†	0.188†	0.248**	0.227**
	(0.121)	(0.114)	(0.092)	(0.087)
Rel. Wage	-0.087	-0.237*	0.32	-0.245
	(0.209)	(0.104)	(0.222)	(0.136)
Number of Obs.	1983	2002	1983	2002

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

[45] The significance tests in the estimation are based on a two-tailed test.

Also, the relative wage effect on vertical FDI is negative but statistically significant only under the random effects, but again a Hausman test is unable to distinguish between the fixed effects and the random effects. These results are by no means sufficient evidence for the exchange rate effect on vertical FDI. However, it shows that a more careful measure of vertical FDI could expose more evidence for the exchange rate effect on vertical FDI.

In summary, the estimation results provide strong evidence that a depreciation of a host country currency is correlated with a *decrease* in horizontal FDI into that country, but the results provide weak evidence that a depreciation of a host country currency is correlated with an *increase* in vertical FDI into that country. However, an additional analysis shows that a more careful measure of vertical FDI may help to reveal more evidence for the exchange rate effect on vertical FDI. Also, the empirical results show that a relatively high real wage in a host country decreases both horizontal FDI and vertical FDI into that country.

II.7. Conclusion

This chapter provides empirical evidence for the model's prediction in the first chapter that the exchange rate effects on FDI differ in terms of the types of FDI. The estimation results suggest that a depreciation of a host country currency may depress horizontal FDI into that country, as predicted by the first chapter, but the results do not provide solid evidence that a depreciation of a host country currency may promote vertical FDI into that country. However, an additional analysis shows

that a more careful measure of vertical FDI could expose more evidence for the exchange rate effect on vertical FDI. Additionally, the empirical results suggest that a relatively high real wage in a host country may discourage both horizontal FDI and vertical FDI into that country, as expected by the first chapter.

In future work, it will be interesting to see how the results hold when FDI flow data (in monetary unit) are used, instead of FDI count data. Although the FDI count data in the analyses are very useful to examine the exchange rate effects on different types of FDI, the count data may not completely resolve heterogeneity in FDI. Therefore, using FDI flow data may provide more insight into this issue and may bring more perspective on the exchange rate effect on different types of FDI.

Moreover, as pointed out in the first chapter, the expectations of the exchange rate will shed more light on the exchange rate effects on different types of FDI, so it will be interesting to see how controlling for the expectations of the exchange rate will affect the exchange rate effect on different types of FDI. Perhaps, exchange rate expectations could bring more evidence for the exchange rate effect on vertical FDI. This will be investigated further in the next chapter.

CHAPTER III

THE EXPECTED EXCHANGE RATE EFFECTS ON THE DIFFERENT TYPES OF FOREIGN DIRECT INVESTMENT

III.1. Introduction

The exchange rate is a price that determines the allocation of resources internationally. How the exchange rate affects the allocation of foreign direct investment (FDI) is theoretically shown in the first chapter. While a depreciation of a host country currency decreases horizontal FDI into that country, a depreciation of a host country currency increases vertical FDI into that country. Moreover, considerable empirical evidence for these exchange rate effects on different types of FDI is shown in the second chapter. In this third chapter, the exchange rate effects on different types of FDI are combined with an analysis of exchange rate expectation on FDI.

Like the exchange rate level, the expectation of the exchange rate movements may also affect the allocations of FDI. As demonstrated in a simple two-period time frame in the first chapter, a foreign direct investor could change the timing of FDI in light of the expectations of the exchange rate. Depending on a certain level of depreciation of a host country currency, a foreign direct investor may delay or bring forward his FDI. If the expected depreciation of a host country currency exceeds the

threshold of depreciation, a foreign direct investor would make his FDI in the second period, instead of the first period, because postponing FDI would be more profitable than making FDI in the first period. If otherwise, the foreign direct investor would make FDI in the first period because postponing FDI would be less profitable (see section III.5 for more).

The above reasoning applies in exactly the same way to both horizontal and vertical FDI, even though the precise threshold for horizontal FDI differs from the threshold for vertical FDI, which depends on the value of the parameters given in the theoretical model (see the first chapter for more).[46] A comparable analysis can be found in the study of Chakrabarti and Scholnick (2002). Chakrabarti and Scholnick suggest that a small shock and a large shock to exchange rate may matter to FDI activity, and they find that a huge depreciation of a host country currency may be positively correlated with increases in FDI inflow to that country in the near future, but a small depreciation of a host country currency may not be all that correlated with increases in FDI inflow to that country in the near future.

Based on the simple dynamic model in the first chapter, this third chapter investigates how expectations of exchange rate movements may affect the allocation of FDI. As reviewed in the first chapter, Campa (1993), Cushman (1985) and Chen et al. (2006) are representative studies regarding the link between the expected exchange rate and FDI (see the first chapter for details). In brief, Campa (1993) predicts that the expected depreciation of a host country currency is negatively

[46] See the first chapter for the definitions of horizontal FDI and vertical FDI.

correlated with FDI inflow to that country, but contradictorily, his empirical study shows a statistically significant, positive relation between the expected depreciation of a host country currency and the FDI inflow under both assumptions of perfect forecast expectation and static expectation.

On the other hand, Cushman (1985) shows that the expected depreciation of a host country currency can be positively or negatively correlated with FDI into that country. But, his empirical study supports a statistically significant, positive relation between the expected depreciation of a host country currency and FDI into that country under both assumptions of stabilizing expectations and regressive expectations.

Unlike above studies, Chen *et al.*, (2006) divide FDI into two groups: market-oriented FDI and cost-oriented FDI. Then, it is shown that while there is a negative relation between the expected depreciation of a host country currency and market-oriented FDI into that country, there is a positive relation between the expected depreciation of a host country currency and cost-oriented FDI into that country. Using the exchange rate trend as a measure of the expected exchange rate, they show empirical support for their claims.

Additionally, Jeon and Rhee (2002) predict that the expected depreciation of a host country currency reduces FDI inflow to that country because of a wait-and-see attitude among foreign direct investors. Their empirical study shows strong support for their predictions under the assumption of perfect forecast expectations.

I too divide FDI into two groups, but I focus on different types of FDI: horizontal FDI and vertical FDI. And, it has been shown in the first chapter that depending on the threshold of depreciation of a host country currency, a relation between the expected depreciation of a host country currency and horizontal FDI into that country can be negative or zero, and similarly a relation between the expected depreciation of a host country currency and vertical FDI into that country can also be negative or zero. Moreover, I conjecture that the expectation of the exchange rate sheds more light on the exchange rate effects on different types of FDI because the expectation of the exchange rate movements would affect the timing of FDI, as implied by the relation between the expected depreciation of a host country and FDI into that country (see section III.5 for more).

Accordingly, this chapter explores not only how robust the expected exchange rate effects on different types of FDI are to the various measures of the expected exchange rate under different assumptions of exchange rate expectation, but also how the expectations of the exchange rate affect the exchange rate effects on different types of FDI in the second chapter. In order to examine these, I use four different assumptions: perfect forecast expectation, adaptive expectation, rational expectation and risk-adjusted expectation. Under these exchange rate expectations, I construct the various measures of the expected exchange rate. These measures of the expected exchange rate are used for the analysis along with the different measures of horizontal FDI and vertical FDI in the second chapter.

Interestingly, the empirical results show that the expected exchange rate effects on different types of FDI are not robust under the different assumptions of exchange rate expectations. In fact, the expected exchange rate doesn't seem to have significant effects on different types of FDI. However, the expectations of the exchange rate shed more light on the exchange rate effects on different types of FDI under all of the exchange rate expectations. This may suggest that the exchange rate is a more influential determinant of the allocation of different types of FDI than the expected exchange rate.

This chapter proceeds as follow. The empirical model and the estimation methods, including dependent variables and explanatory variables, are explained in the following section. Section 3 discusses the expected signs of the explanatory variables, and section 4 gives details on the estimation results. The conclusion and discussion are provided in the final section.

III.2. Estimation

The empirical model in the second chapter can be easily modified to examine the expected exchange rate effects on different types of FDI. Adding the expected exchange rate to the previously identified determinants of FDI in the second chapter, the following empirical model is proposed to estimate the expected exchange rate effects: [47]

[47] The exchange rate is the one year lagged exchange rate, as in the second chapter.

$$(1) \qquad FDI\ activity = f\begin{pmatrix} expected\ exchange\ rate, \\ exchange\ rate, \\ relative\ real\ wage, \\ other\ controls \end{pmatrix}$$

The dependent variable of FDI activity is explained by the expected exchange rate, the exchange rate, the relative real wage of a host and a home country, and other explanatory variables including year dummies to control for time-related aggregate effects on FDI activity. Moreover, as in the second chapter, country pair fixed effects estimation is applied to control for unobserved country specific characteristics and time-constant factors that might affect FDI activity. The following sections explain all the variables, the data and the estimation methods.[48]

III.2.1. Explanatory Variables

The dependent variable and the explanatory variables are the exactly same as those in the second chapter. And, the data set and the estimation methods are also the exactly same as in the second chapter. The only exception is the expected exchange rate. Thus, this section explains the new variable and how to measure it. Refer to the second chapter for the dependent variable of FDI activity, the exchange rate, the relative real wage of a host and a home country, the data set, and the estimation method.

As for the expectations of the exchange rate, there is no simple rule for how to measure exchange rate expectations. Therefore, four different measures of

[48] See the second chapter for the functional form of $f(\cdot)$.

exchange rate expectations are examined: Perfect forecast expectation, adaptive expectation, rational expectation, and risk-adjusted rational expectation. Prefect forecast expectation is frequently used in the previous literature (see Campa (1993) and Jeon and Rhee (2008), for example), so I simply follow previous studies for comparison purposes. Adaptive expectation and rational expectation are chosen to describe more practical views on exchange rate expectation.[49] Adaptive expectation represents a random walk of the exchange rate, and rational expectation reflects the uncovered interest parity condition (see Krugman and Obstfeld (2007)).

Although there are many macroeconomic exchange rate models, a random walk model and the interest parity condition are relatively simple and easy to implement in forecasting exchange rate movements. Moreover, it has been reported that a random walk model outperforms sophisticated macroeconomic models in forecasting exchange rate movements over the short run horizon, roughly in a year.

To create a measure of the perfect forecast expectation, I use the *realized* real exchange rate at time $t+1$ in unit-free terms as the expectations of the exchange rate at time $t+1$. The expectation of the exchange rate at time $t+1$ is needed because the expected time $t+1$ exchange rate can affect FDI made at time t. According to the dynamic model in the first chapter, if the exchange rate at time $t+1$ is expected to exceed the threshold of depreciation of a host country currency at which a foreign

[49] Regressive expectations and stabilizing expectations in Cushman (1985) are less practical than adaptive expectation and rational expectation for the purpose of this chapter because the mean reverting behavior of the exchange rate seems to hold for long run exchange rate movements. See Krugman and Obstfeld (2007), and Chakrabarti and Scholnick (2002) for more.

direct investor would postpone his FDI, the FDI will be made at time *t+1*, rather than time *t*.

Thus, under the assumption of perfect forecast expectation, FDI made at time *t* can be explained by the realized real exchange rate at time *t+1* in unit-free terms. The following specification is proposed to estimate the expected exchange rate effects on different types of FDI under the perfect forecast expectation.[50]

$$(2) \qquad FDI\ activity_t = f\left(\underbrace{exchange\ rate_{\ t+1}}_{expected\ exchange\ rate}, others_{t-1}\right)$$

Alternatively, to model the adaptive expectations I use the real exchange rate at time *t* in unit-free terms as the expectations of the exchange rate at time *t+1* since adaptive expectations implies that the expectations of the exchange rate depends on the lagged exchange rate. Thus, FDI at time *t* can be explained by the real exchange rate at time *t* in unit-free terms.[51] It follows that under adaptive expectation, the expected exchange rate effects on different types of FDI is estimated by the following specification:

$$(3) \qquad FDI\ activity_t = f\left(\underbrace{exchange\ rate_{\ t}}_{expected\ exchange\ rate}\ others_{t-1}\right)$$

[50] Recall that the other explanatory variables are one year lagged because of time-consuming FDI decision. See the second chapter for more.

[51] Time can be blurred in this case. But assume that a foreign direct investor is at time *t* before making his FDI.

A measure of rational expectations is based on the uncovered interest parity condition, which implies that exchange rate movements are predicted by the interest rate differential. Equation (4) depicts the uncovered interest parity condition.[52]

$$\frac{E_{t+1}^{e} - E_t}{E_t} = i_t^{host} - i_t^{home} \tag{4}$$

E denotes the price of a home country currency in a host country currency. $E_{t+1}^{e}$is the expectation of the exchange rate at time *t+1*. i_t^{host} is the host country interest rate at time *t,* and i_t^{home} is the home country interest rate at time *t.*

Equation (4) suggests that the expected exchange rate change at time t is predicted by the difference between the host country interest rate and the home country interest rate at time t. In view of this relation, E_{t+1}^{e} can be obtained explicitly by solving for E_{t+1}^{e}:

$$E_{t+1}^{e} = E_t \times \left(i_t^{host} - i_t^{home}\right) + E_t \tag{5}$$

With this result, I normalize the term on the right hand side, following the previous normalization process, and the normalized term is used as the expectations of the

[52] See Krugman and Obstfeld (2007) for details on rational expectation and the interest parity condition.

exchange rate at time *t+1*. Hence, the empirical specification under the assumption of rational expectation is suggested by:

$$(6) \qquad FDI\ activity_t = f\left(\underbrace{E_t \times \left(i_t^{host} - i_t^{home}\right) + E_t}_{expected\ exchange\ rate}, others_{t-1}\right)$$

Additionally, the interest parity condition assumes a fixed price level because it is a short run model.[53] Therefore, in order to control for price effects on the expected exchange rate, the GDP deflator of a host country and of a home country at time *t* is included in the specification.

Although the interest parity condition tends to hold under some circumstances, the interest rate differential is not a good predictor of the expected exchange rate change in general.[54] One explanation of the poor performance is imperfect asset substitutability: I.e., ignoring relative risk on assets across countries. Therefore, taking relative risk into account, the interest parity condition can be modified as:

$$(7) \qquad \frac{E_{t+1}^e - E_t}{E_t} = \left(i_t^{host} - i_t^{home}\right) - \left(\rho_t^{host} - \rho_t^{home}\right)$$

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[53] The nominal exchange rate is used in obtaining the expected exchange rate.

[54] There is evidence that the covered interest parity holds, but the uncovered interest parity fails to predict large swings in the exchange rate. See Krugman and Obstfeld (2007) for more.

where ρ_t^{host} is risk premium on host country asset at time t and ρ_t^{home} is risk premium on home country asset at time t. The second term on the right expresses relative risk premium of a host country and a home country.

Similar to under rational expectation, solving for E_{t+1}^e and normalizing the term on the right hand side in equation (8), I use the normalized term as the expectations of the exchange rate at time *t+1* under the assumption of risk-adjusted rational expectation.

$$E_{t+1}^e = E_t \times \left[\left(i_t^{host} - i_t^{home}\right) - \left(\rho_t^{host} - \rho_t^{home}\right)\right] + E_t \tag{8}$$

Thus, FDI activity is explained by the following specification under risk-adjusted rational expectation:[55]

$$FDI\ activity_t = f\left(\underbrace{E_t \times \left[\left(i_t^{host} - i_t^{home}\right) - \left(\rho_t^{host} - \rho_t^{home}\right)\right] + E_t}_{expected\ exchange\ rate}, others_{t-1}\right) \tag{9}$$

To measure interest rates and risk premiums, I have collected data on the prime (interest) rate and the Treasury bill interest rate. The prime rate is the rate charged by banks on loans to prime customers, and the Treasury bill interest rate is the rate at which short term government securities are traded. The prime rate in a

[55] The price effect on the expected exchange rate is explicitly controlled for, as in rational expectations.

host country and a home country has been used for i_t^{host} and i_t^{home}, and the spread between the prime rate and the treasury bill rate is used as risk premium since the treasury bill rate is considered to be risk free.[56] The expected exchange rate in equation (9) is, therefore, measured by the Treasury bill rate. Table 3.1 summarizes the measure of the expectation of the exchange rate under the different assumptions of exchange rate expectation.

Table 3.1. The Measure of the Expectations of the Exchange Rate.

Exchange Rate Expectations	The Expectation of the Exchange Rate
Prefect Forecast Expectation	$exchange\ rate_{t+1}$
Adaptive Expectation	$exchange\ rate_t$
Rational Expectation	$E_t \times \left(i_t^{host} - i_t^{home}\right) + E_t$
Risk-Adjusted Rational Expectation	$E_t \times \left[\left(i_t^{host} - i_t^{home}\right) - \left(\rho_t^{host} - \rho_t^{home}\right)\right] + E_t$

Note: The measure of the expectations of the exchange rate is normalized, so that it is expressed in unit-free terms.

III.3. Expected Sign of Explanatory Variables

The theoretical model in the first chapter hypothesizes that while a depreciation of a host country currency is correlated with a decrease in horizontal FDI into the country, a depreciation of a host country currency is correlated with an increase in vertical FDI into the country. Also, the simple dynamic model in the first chapter implies that, depending on the threshold of depreciation of a host country currency, the expected exchange rate effect on horizontal FDI may be either positive

[56] The source of the data is WDI (the World Development Indicator) database.

or negative, and similarly the expected exchange rate effect on vertical FDI may be either positive or negative.

Moreover, the expected exchange rate effects on different types of FDI imply that the expectations of the exchange rate have an effect on the exchange rate effects because the expectations of the exchange rate movements may affect the timing of FDI. Particularly, depending on the expectations of the exchange rate, the expected exchange rate effects on different types of FDI may lessen or enlarge the exchange rate effects.

As demonstrated in the two-period model in the first chapter, if a host country currency is expected to depreciate to a certain level, a foreign direct investor would postpone his FDI until the second period because making the FDI in the second period will be more profitable than making it in the first period. This part of the model implies that the expectation of the exchange rate will be able to weaken the exchange rate effects on different types of FDI. Although the model shows that there is a threshold level of depreciation of a host country currency that makes horizontal FDI and vertical FDI more profitable if FDI is postponed, the exact level of depreciation of a host country currency for horizontal FDI and vertical FDI differs.

On the other hand, not all the expected depreciation of a host country currency will weaken the exchange rate effects. The expected depreciation *below* the threshold level may not cause a foreign direct investor to postpone his FDI. Instead, it will lead the investor to bring forward his FDI because making his FDI in the first period will be more profitable than making it in the second period. In this sense, the

expectations of the exchange rate will be able to strengthen the exchange rate effects on different types of FDI. As a result, having control for the expectations of the exchange rate will shed more light on the exchange rate effects on different types of FDI.

Table 3.2. Expected Sign of Explanatory Variable.

FDI	Explanatory Variables		
	Exp. ER	ER	Rel. Wage
Horizontal	0/−	−	−
Vertical	0/−	+	−

Table 3.2 provides the expected sign of each explanatory variable. The expected sign of the expected exchange rate (Exp. ER) can be negative or zero for both horizontal FDI and vertical FDI because a foreign direct investor may postpone or bring forward his FDI depending on the expectations of exchange rate movements. The expected sign of the exchange rate (ER) is *negative* for horizontal FDI, while the expected sign is *positive* for vertical FDI. However, controlling for the expectation of the exchange rate, the exchange rate effects on both FDI are expected to be altered (Either weakened or strengthened), compared to the exchange rate effects in the second chapter, which does not control for the expectations of the exchange rate.

As a reference, Campa (1993) and Jeon and Rhee (2008) predict that the expected sign of the expected exchange rate is negative.[57] But Cushman (1985)

[57] Recall that the exchange rate is expressed as a host country currency *per* a home country currency.

shows that the expected sign can be either negative or positive based on 4 cases that he considered. Chen *et al.* (2006) expect that the expected sign of the expected exchange rate is negative for market-oriented FDI, but positive for cost-oriented FDI. Nonetheless, these theoretical claims are not easily confirmed by their empirical studies. Campa (1993) reports a statistically significant, positive effect of the expected exchange rate on FDI, and Cushman (1985) reports a statistically significant, positive effect of the expectation of the exchange rate. Jeon and Rhee (2008) and Chen et al. (2006), however, show some empirical supports for their claims.[58]

The expected sign of the relative real wage (Rel. Wage) for both horizontal FDI and vertical FDI is negative, as the theoretical model in the first chapter shows. The negative sign implies that relatively high wage in a host country will reduce foreign direct investor's profit, so that both types of FDI are less likely to occur (See Campa (1993), Chen *et al.* (2006), Hanson et al, (2005), Jeon and Rhee (2008)). The next sections give details on the empirical results of the analyses.

III.4. Estimation Results

As in the second chapter, a Poisson regression model with fixed and random effects, and a negative binominal regression model with fixed and random effects are used to examine the exchange rate effects on different types of FDI. Also, the

[58] Refer to the second chapter for the expected sign of the exchange rate examined by previous studies.

exact same tests as in the previous chapter are in place to evaluate each estimation method. First, the likelihood ratio test of discriminating between a pooled regression model and a panel regression model indicates that a panel regression model is preferred for every single regression that has been estimated. Once again, this result is not really surprising given the patterns of M&A observed in graphs 2.1 and 2.2.

Second, the likelihood ratio test of discerning between a negative binomial regression model and a Poisson regression model suggests that a negative binomial regression model is preferred for all the estimated regressions. In addition, α-statistics also confirms that a negative binomial regression model is preferred. However, for the fourth measure of vertical FDI under the assumption of risk-adjusted rational expectations, α-statistics indicates that a Poisson regression model does not significantly differ from a negative binomial regression model. In this case, the negative binomial regression model is considered together with the Poisson regression model. More details follow in the subsequent sections.

III.4.1. Perfect Forecast Expectation

Table 3.3 below reports the empirical results on the various measures of horizontal FDI under the assumption of perfect forecast expectation (PE).[59] The negative binomial regression model reveals that the effect of the expected exchange

[59] The coefficients of year dummies are not reported in the table. See the appendix for the complete estimation results.

rate (Exp. ER) on the horizontal FDI measured by the first measure is effectively zero. It implies that under prefect forecast expectation assumption, the expected depreciation of a host country currency is smaller than the threshold level of depreciation at which a foreign direct investor would postpone horizontal FDI, so that foreign direct investors brought forward horizontal FDI. Although the Poisson regression model provides similar results, the likelihood ratio test and α-statistics indicate that the negative binomial regression model is more appropriate than the Poisson regression model (see the appendix for the complete estimation results including the likelihood ratio test and α-statistics).

The exchange rate (ER) effect on the horizontal FDI measured by the first measure is negative and statistically significant at the 1% level. Moreover, it shows substantial improvement, compared with the exchange rate effect on horizontal FDI without controlling for the expectations of the exchange rate in the second chapter. The coefficient (-0.446) measures that 10% increase in the exchange rate would reduce horizontal FDI by about 2.6%, which is 1.2 percentage point higher than when the expectations of the exchange rate is not controlled for (see table 2.6). Similarly, the negative effect of the relative real wage (Rel. Wage) on horizontal FDI measured by the first measure is significant at the 1% level and also improved, compared with the wage effect without controlling for the expectation of exchange rate (See table 2.6).

Table 3.3. The Expected Exchange Rate Effect on Horizontal FDI under Perfect Forecast Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (PE)	0.087	0.072	0.093†	0.094†
	(0.093)	(0.093)	(0.049)	(0.049)
ER	-0.446***	-0.426***	-0.659***	-0.654***
	(0.102)	(0.101)	(0.053)	(0.053)
Rel. Wage	-0.080***	-0.106***	-0.091***	-0.120***
	(0.018)	(0.017)	(0.021)	(0.019)
Number of Obs.	4203	4270	4203	4270
Measured by (2)				
Exp. ER (PE)	-0.028	-0.059	0.038	0.011
	(0.082)	(0.081)	(0.065)	(0.064)
ER	-0.314***	-0.322***	-0.306***	-0.327***
	(0.087)	(0.084)	(0.069)	(0.066)
Rel. Wage	-0.054**	-0.075***	-0.053*	-0.070***
	(0.021)	(0.015)	(0.023)	(0.016)
Number of Obs.	13997	14601	13997	14601
Measured by (3)				
Exp. ER (PE)	-0.201	-0.212	-0.024	-0.028
	(0.139)	(0.139)	(0.097)	(0.096)
ER	-0.615***	-0.577***	-0.642***	-0.634***
	(0.151)	(0.150)	(0.105)	(0.103)
Rel. Wage	-0.093**	-0.132***	-0.107**	-0.144***
	(0.031)	(0.025)	(0.041)	(0.026)
Number of Obs.	3623	3696	3623	3696
Measured by (4)				
Exp. ER (PE)	-0.13	-0.128	0.018	0.02
	(0.131)	(0.130)	(0.058)	(0.058)
ER	-0.497***	-0.493***	-0.717***	-0.711***
	(0.138)	(0.137)	(0.063)	(0.063)
Rel. Wage	-1.184**	-1.053**	-0.344	-0.278
	(0.366)	(0.358)	(0.223)	(0.218)
Number of Obs.	810	810	810	810
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (PE)	-0.025	-0.050	0.009	0.002
	(0.055)	(0.054)	(0.035)	(0.035)
ER	-0.166**	-0.171**	-0.264***	-0.267***
	(0.057)	(0.057)	(0.037)	(0.036)
Rel. Wage	-0.037**	-0.068***	-0.057***	-0.080***
	(0.012)	(0.011)	(0.012)	(0.011)
Number of Obs.	17317	17909	17317	17909

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The strengthened exchange rate effect and the strengthened wage effect clearly illustrate that the expectation of the exchange rate matters. In particular, the strengthened exchange rate effect can be supportive evidence that the expectation of the exchange rate shed more light on the exchange rate effect. This revealing relation is observed repeatedly for the other measures of horizontal FDI.

The negative binomial regression model, preferred by the likelihood ratio test and α-statistics, also discloses that the expected exchange rate effect on horizontal FDI measured by the other measures are zero, as predicted by the model. And, the exchange rate effect under the other three measures of horizontal FDI is negative and statistically very significant (at the 1% level). The exchange rate effect is also strengthened.

Similarly, the relative real wage effect on horizontal FDI measured by the other three measures is negative and statistically very significant. The wage effect is also strengthened, having controlled for the expectation of the exchange rate. Especially, the strengthened exchange rate effects confirm once more that the expectation of the exchange rate has an effect on the exchange rate effect on horizontal FDI.

Accordingly, the empirical results under perfect forecast expectation assumption provide the substantial evidence for the exchange rate effect and the relative real wage effect on horizontal FDI. Also, the results show that the expectations of the exchange rate have an effect on the exchange rate effect on horizontal FDI.

Additionally, the negative binomial regression model based on the overall FDI (I.e., FDI before discriminating between horizontal FDI and vertical FDI) reveals the exact same patterns as the previous results based on the various measures of horizontal FDI (see the bottom part of the table). The expected exchange rate under the perfect forecast expectation is zero, and the exchange rate effect on overall FDI is statistically very significant and negative.[60] The relative real wage effect on overall FDI is negative and very significant. Additionally, the effect of the exchange rate and relative wage is stronger than those effects without control for the expectation of the exchange rate examined in the second chapter.

Table 3.4 reports the estimation results on the different measures of vertical FDI under the assumption of perfect forecast expectation. Favored by the likelihood ratio test and α-statistics, the negative binomial regression model reveals that the expected exchange rate effect on vertical FDI is zero under all of the measures. Although the fixed effects under the first measure of vertical FDI show the expected exchange rate effect on vertical FDI is statistically significant at the 10% level, a Hausman test favors the random effect under the first measure of vertical FDI. Once again, the zero effect implies that the expected depreciation of a host country currency is smaller than the threshold level for vertical FDI.

[60] This negative effect of exchange rate on FDI is similar to the empirical results of Campa (1993), Chakrabarti and Scholnick (2002), and Jeon and Rhee (2008). See the second chapter for more.

Table 3.4. The Expected Exchange Rate Effect on Vertical FDI under Perfect Forecast Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (PE)	0.168†	0.112	0.048	0.017
	(0.102)	(0.102)	(0.078)	(0.077)
ER	-0.066	-0.09	0.000	-0.011
	(0.101)	(0.100)	(0.080)	(0.078)
Rel. Wage	-0.112	-0.258**	0.303†	-0.264*
	(0.184)	(0.085)	(0.182)	(0.105)
Number of Obs.	2967	3094	2967	3094
Measured by (2)				
Exp. ER (PE)	-0.028	-0.054	0.008	0.001
	(0.062)	(0.061)	(0.041)	(0.041)
ER	-0.122†	-0.131*	-0.235***	-0.236***
	(0.065)	(0.064)	(0.043)	(0.043)
Rel. Wage	-0.033*	-0.068***	-0.043**	-0.073***
	(0.013)	(0.012)	(0.013)	(0.012)
Number of Obs.	16306	16859	16306	16859
Measured by (3)				
Exp. ER (PE)	0.171	0.103	0.056	0.016
	(0.119)	(0.118)	(0.096)	(0.094)
ER	-0.038	-0.071	0.078	0.063
	(0.119)	(0.117)	(0.097)	(0.094)
Rel. Wage	0.138	-0.187†	0.395†	-0.204†
	(0.238)	(0.099)	(0.212)	(0.124)
Number of Obs.	2733	2867	2733	2867
Measured by (4)				
Exp. ER (PE)	0.189	0.155	0.131	0.146
	(0.151)	(0.150)	(0.124)	(0.120)
ER	0.14	0.068	0.276*	0.248*
	(0.146)	(0.146)	(0.115)	(0.114)
Rel. Wage	3.425***	2.229***	7.892***	5.231***
	(0.807)	(0.622)	(0.964)	(0.861)
Number of Obs.	843	843	843	843
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (PE)	-0.025	-0.050	0.009	0.002
	(0.055)	(0.054)	(0.035)	(0.035)
ER	-0.166**	-0.171**	-0.264***	-0.267***
	(0.057)	(0.057)	(0.037)	(0.036)
Rel. Wage	-0.037**	-0.068***	-0.057***	-0.080***
	(0.012)	(0.011)	(0.012)	(0.011)
Number of Obs.	17317	17909	17317	17909

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The exchange rate effect on vertical FDI is statistically insignificant under all of the measures of vertical FDI, except for the second measure. The effect of the exchange rate on vertical FDI measured by the second measure is negative, which is at odd with the model's prediction. This result is quite puzzling. Perhaps the second measure of vertical FDI may not be an accurate measure of vertical FDI. Or, M&A inflow might not reflect vertical FDI accurately. Either way, this result asks for a more careful measure of vertical FDI: An alternative measure of vertical FDI will be considered later on (see Table 3.11).

The relative real wage effect on vertical FDI measured by all of the measures is negative, except for the fourth measure. Moreover, the negative wage effect on vertical FDI is all statistically significant because a Hausman test prefers the random effects under the first and the third measure of vertical FDI. Despite that, the wage effect under the fourth measure of vertical FDI is statistically significant but positive. This unexpected result also calls for a more accurate measure of vertical FDI.

Under perfect forecast expectation assumption, the expected exchange rate effect on vertical FDI is zero, but the exchange rate effect on vertical FDI is not in favor of what the model predicts. While support for the negative wage effect on vertical FDI can be found, the wage effect is not strengthened, compared with the wage effect without controlling for the expectation of the exchange rate. The lack of empirical evidence for the exchange rate effect on vertical FDI may call for a more careful measure of vertical FDI.

III.4.2. Adaptive Expectation

This section explains the estimation results on the various measures of horizontal FDI and vertical FDI under the assumption of adaptive expectations. Table 3.5 below shows the empirical results on horizontal FDI under adaptive expectation assumption.

Favored by the likelihood test and α-statistics, the negative binomial regression model reveals that the expected exchange rate effect on horizontal FDI is zero. Although the expected exchange rate effect on the first measure of horizontal FDI is statistically significant at the 10% level, a Hausman test is unable to tell whether the fixed effects are preferred. In this case, I regard it as inconclusive evidence.

The negative binomial regression model also reveals that the negative effect of exchange rate on horizontal FDI is highly significant under all of the measures of horizontal FDI. Moreover, Controlling for the expectation of the exchange rate strengthens the exchange rate effect on horizontal FDI, except for the fourth measure of horizontal FDI. The exchange rate effect under the fourth measure is statistically significant and negative, but the effect is actually weaker than the exchange rate effect without controlling for the expectation of the exchange rate (see table 2.6).

Table 3.5. The Expected Exchange Rate Effect on Horizontal FDI under Adaptive Expectation

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (AE)	0.223†	0.202	0.150*	0.150*
	(0.130)	(0.130)	(0.068)	(0.068)
ER	-0.440**	-0.419**	-0.609***	-0.605***
	(0.137)	(0.137)	(0.071)	(0.071)
Rel. Wage	-0.076***	-0.100***	-0.085***	-0.114***
	(0.018)	(0.016)	(0.020)	(0.018)
Number of Obs.	4443	4482	4443	4482
Measured by (2)				
Exp. ER (AE)	0.167	0.123	0.244**	0.216*
	(0.114)	(0.114)	(0.090)	(0.089)
ER	-0.381***	-0.396***	-0.393***	-0.416***
	(0.115)	(0.114)	(0.091)	(0.090)
Rel. Wage	-0.049*	-0.070***	-0.043*	-0.063***
	(0.020)	(0.015)	(0.022)	(0.016)
Number of Obs.	15019	15309	15019	15309
Measured by (3)				
Exp. ER (AE)	0.032	0.01	0.21	0.202
	(0.191)	(0.192)	(0.133)	(0.133)
ER	-0.625**	-0.595**	-0.667***	-0.665***
	(0.202)	(0.202)	(0.140)	(0.139)
Rel. Wage	-0.085**	-0.124***	-0.094*	-0.134***
	(0.030)	(0.024)	(0.039)	(0.026)
Number of Obs.	3819	3880	3819	3880
Measured by (4)				
Exp. ER (AE)	-0.147	-0.146	-0.011	-0.011
	(0.181)	(0.180)	(0.082)	(0.082)
ER	-0.392*	-0.389*	-0.585***	-0.582***
	(0.186)	(0.186)	(0.085)	(0.085)
Rel. Wage	-0.871**	-0.774*	0.121	0.153
	(0.334)	(0.327)	(0.201)	(0.197)
Number of Obs.	852	852	852	852
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (AE)	0.090	0.061	0.08†	0.074
	(0.076)	(0.076)	(0.048)	(0.048)
ER	-0.184*	-0.190*	-0.261***	-0.265***
	(0.076)	(0.076)	(0.049)	(0.049)
Rel. Wage	-0.034**	-0.064***	-0.054***	-0.078***
	(0.012)	(0.010)	(0.012)	(0.011)
Number of Obs.	18486	18765	18486	18765

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

Similarly, the relative real wage effect on horizontal FDI under all of the measures of horizontal FDI is statistically significant and negative. However, the wage effect is not as strong as the wage effect under perfect forecast expectation. In fact, the wage effect is slightly weaker than the wage effect without controlling for the expectation of the exchange rate.

The estimation based on overall FDI provides very similar results. The expected exchange rate effect on overall FDI is zero, and the exchange rate effect on overall FDI is statistically significant and negative. The relative real wage effect on overall FDI is also statistically significant and negative. However, while the exchange rate effect is stronger than the exchange rate effect without controlling for the expectation of the exchange rate, the wage effect is slightly weaker than the wage effect without controlling for the expectation of the exchange rate.

To sum up, the empirical evidence shows that the expected exchange rate effect on horizontal FDI under adaptive expectation assumption is zero, as expected. The empirical evidence also shows that the negative exchange rate effect and the negative relative wage effect on horizontal FDI are stronger, controlling for the expectations of the exchange rate. The strengthened exchange rate effect provides more evidence that the expectation of the exchange rate have an effect on the exchange rate effect on horizontal FDI.

Table 3.6. The Expected Exchange Rate Effect on Vertical FDI under Adaptive Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (AE)	0.328*	0.263†	0.198†	0.164
	(0.156)	(0.155)	(0.115)	(0.113)
ER	-0.222	-0.228	-0.126	-0.133
	(0.139)	(0.140)	(0.106)	(0.105)
Rel. Wage	-0.172	-0.268**	0.257	-0.273**
	(0.159)	(0.084)	(0.185)	(0.103)
Number of Obs.	3089	3203	3089	3203
Measured by (2)				
Exp. ER (AE)	0.046	0.019	0.023	0.018
	(0.085)	(0.085)	(0.057)	(0.056)
ER	-0.112	-0.123	-0.197***	-0.201***
	(0.086)	(0.086)	(0.058)	(0.057)
Rel. Wage	-0.031*	-0.065***	-0.042**	-0.071***
	(0.013)	(0.011)	(0.013)	(0.012)
Number of Obs.	17368	17663	17368	17663
Measured by (3)				
Exp. ER (AE)	0.175	0.109	0.093	0.057
	(0.179)	(0.179)	(0.138)	(0.135)
ER	-0.084	-0.101	0.025	0.017
	(0.162)	(0.162)	(0.127)	(0.125)
Rel. Wage	0.064	-0.197*	0.368†	-0.211†
	(0.240)	(0.098)	(0.212)	(0.123)
Number of Obs.	2830	2968	2830	2968
Measured by (4)				
Exp. ER (AE)	0.295	0.257	0.262	0.261
	(0.228)	(0.226)	(0.176)	(0.172)
ER	-0.058	-0.104	0.099	0.065
	(0.204)	(0.204)	(0.153)	(0.152)
Rel. Wage	1.859**	1.341*	5.652***	3.740***
	(0.667)	(0.552)	(0.884)	(0.740)
Number of Obs.	877	877	877	877
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (AE)	0.090	0.061	0.08	0.074
	(0.076)	(0.076)	(0.048)	(0.048)
ER	-0.184*	-0.190*	-0.261***	-0.265***
	(0.076)	(0.076)	(0.049)	(0.049)
Rel. Wage	-0.034**	-0.064***	-0.054***	-0.078***
	(0.012)	(0.010)	(0.012)	(0.011)
Number of Obs.	18486	18765	18486	18765

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

Table 3.6 reports the estimation results on the various measures of vertical FDI under adaptive expectation assumption. Preferred by the likelihood test and α-statistics, the negative binomial regression model uncovers that the expected exchange rate effect on vertical FDI is zero except for the first measure. The random effects under the first measure of vertical FDI, favored by a Hausman test, show that the effect of the expected exchange rate on vertical FDI is positive at the 10% level.[61] However, this positive expected exchange rate effect is not consistent with the model's prediction. This conflicting result may call for a more careful measure of vertical FDI once again.

Moreover, the exchange rate effect on vertical FDI is not supported by the results. The negative binomial regression model reveals that under adaptive expectation assumption the exchange rate effect is statistically insignificant under all of the measures of vertical FDI. The relative real wage effect, however, is statistically significant and negative, except for the fourth measure, since a Hausman test supports the random effects under the first and the third measure of vertical FDI. And yet, the wage effect has not been improved. Besides, the real wage effect on vertical FDI measured by the fourth measure is statistically significant and positive, which is against the model's prediction. This unexpected result also calls attention to a more accurate measure of vertical FDI.

[61] The significance tests in the estimation are based on a two-tailed test, so that a significance test at the 10% level equals to a one-tailed test at the 5% significance level. Nevertheless the significance test for the expected exchange rate should be a two-tailed test because the alternative is two-sided.

It follows that the expected exchange rate effect on vertical FDI under adaptive expectation assumption seems to be zero, but the exchange rate effect on vertical FDI is not in favor of the model's prediction. While the relative wage effect on vertical FDI is consistent with the model's prediction, a more accurate measure of vertical FDI is necessary to show the exchange rate effect on vertical FDI.

III.4.3. Rational Expectation

This section explains the estimation results under the assumption of rational expectation. A distinctive finding is that the expected exchange rate effect on horizontal FDI and vertical FDI is statistically significant and negative, as predicted by the model. And yet, solid support for the exchange rate effect on vertical FDI is still difficult to find. More details are provided in the following.

Table 3.7 shows the empirical results on the different measures of horizontal FDI. Favored by the likelihood ratio test and α-statistics, the negative binomial regression model discovers that the expected exchange rate effect on horizontal FDI under all of the measures of horizontal FDI is zero, except for the second measure. The expected exchange rate effect under the second measure is negative and statistically significant at the 5% level. This is the first statistically significant evidence for the expected exchange rate effect on horizontal FDI.[62]

[62] This negative expected exchange rate on horizontal FDI is similar to Chen et al. (2006). More are discussed later on.

Table 3.7. The Expected Exchange Rate Effect on Horizontal FDI under Rational Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (RE)	-0.004	-0.004	0.003†	0.003†
	(0.003)	(0.003)	(0.002)	(0.002)
ER	-0.634***	-0.576***	-0.816***	-0.788***
	(0.088)	(0.086)	(0.048)	(0.047)
Rel. Wage	-0.061**	-0.100***	-0.046*	-0.090***
	(0.020)	(0.018)	(0.020)	(0.021)
Number of Obs.	3600	3710	3600	3710
Measured by (2)				
Exp. ER (RE)	-0.004*	-0.005*	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
ER	-0.344***	-0.365***	-0.296***	-0.329***
	(0.076)	(0.068)	(0.063)	(0.057)
Rel. Wage	-0.040†	-0.070***	-0.046†	-0.069***
	(0.022)	(0.016)	(0.024)	(0.017)
Number of Obs.	11053	11937	11053	11937
Measured by (3)				
Exp. ER (RE)	-0.005	-0.005	0.001	0.001
	(0.004)	(0.004)	(0.003)	(0.003)
ER	-0.878***	-0.797***	-0.696***	-0.661***
	(0.134)	(0.127)	(0.093)	(0.089)
Rel. Wage	-0.062†	-0.122***	-0.061	-0.131***
	(0.034)	(0.026)	(0.039)	(0.028)
Number of Obs.	3067	3193	3067	3193
Measured by (4)				
Exp. ER (RE)	-0.003	-0.003	0.004*	0.004*
	(0.004)	(0.004)	(0.002)	(0.002)
ER	-0.982***	-0.970***	-1.009***	-1.007***
	(0.123)	(0.121)	(0.057)	(0.056)
Rel. Wage	0.197	0.281	1.311***	1.326***
	(0.411)	(0.399)	(0.253)	(0.246)
Number of Obs.	762	762	762	762
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (RE)	-0.004**	-0.004**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
ER	-0.217***	-0.219***	-0.358***	-0.348***
	(0.050)	(0.048)	(0.034)	(0.032)
Rel. Wage	-0.029*	-0.068***	-0.042***	-0.075***
	(0.013)	(0.011)	(0.013)	(0.012)
Number of Obs.	13808	14494	13808	14494

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The negative expected exchange rate effect on horizontal FDI implies that under rational expectation assumption, the expected depreciation of a host country currency is greater than the threshold level for horizontal FDI, so that foreign direct investors postponed horizontal FDI. The coefficient (-0.004) measures that 10% increase in the expected exchange would reduce horizontal FDI by about 0.02%.

The exchange rate effect on horizontal FDI measured by all of the measures of horizontal FDI under rational expectation is negative and statistically significant at 1% level. Moreover, the exchange rate effect is much strengthened, compared with the exchange rate effect without controlling for the expectation of the exchange rate. For example, the coefficient (-0.634) of the exchange rate under the first measure implies that 10% increase in the exchange rate would reduce horizontal FDI by around 2.4%, which is 1 percentage point higher than when the expectations of the exchange rate is not controlled for. The coefficient (-0.878) under the third measure of horizontal FDI measures that 10% increase in the exchange rate would reduce horizontal FDI by about 4.8%, which is 1.3 percentage points higher than the exchange rate effect without controlling for the expectations of the exchange rate.

The relative real wage effect on horizontal FDI is consistently negative and statistically significant under the all measures of horizontal FDI, except for the fourth measure. The wage effect under the fourth measure is incorrectly positive, but it is not statistically significant. Furthermore, the wage effect under rational expectation is relatively weaker than the wage effect without control for the

expectation of the exchange rate. Even so, the negative wage effect on horizontal FDI is well supported by the estimation results.

In summary, the empirical results under rational expectation assumption provide sufficient evidence for the exchange rate effect and the relative wage effect on horizontal FDI. Moreover, unlike the previous two exchange rate expectation assumptions, a negative expected exchange rare effect on horizontal FDI is observed. This negative and zero expected exchange rate effects confirm once more that the expectations of the exchange rate have an effect on the exchange rate effect on horizontal FDI.

The negative binomial regression model also reveals that the expected exchange rate effect on overall FDI is negative and statistically significant at the 1% level. Again, this is the first statistically significant effect of the expected exchange rate on overall FDI. This negative expected exchange rate effect on overall FDI is similar to the empirical result of Jeon and Rhee (2008).[63] The exchange rate effect and the relative wage effect on overall FDI under rational expectation assumption is similar to those under the previous two assumptions of exchange rate expectations. The exchange rate effect and the relative wage effect on overall FDI are statistically significant and negative.

[63] Campa (1993) theoretically shows that the negative expected exchange rate effect on FDI, but empirically shows the positive expected exchange rate effect.

Table 3.8. The Expected Exchange Rate Effect on Vertical FDI under Rational Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (RE)	-0.003	-0.003	-0.003†	-0.003†
	(0.002)	(0.002)	(0.002)	(0.002)
ER	-0.029	-0.039	-0.053	-0.057
	(0.089)	(0.085)	(0.078)	(0.073)
Rel. Wage	-0.269†	-0.355***	-0.002	-0.428***
	(0.159)	(0.089)	(0.227)	(0.098)
Number of Obs.	2680	2845	2680	2845
Measured by (2)				
Exp. ER (RE)	-0.004*	-0.004*	-0.001	-0.002
	(0.002)	(0.002)	(0.001)	(0.001)
ER	-0.201***	-0.206***	-0.361***	-0.345***
	(0.057)	(0.054)	(0.040)	(0.038)
Rel. Wage	-0.028†	-0.072***	-0.031*	-0.070***
	(0.015)	(0.013)	(0.014)	(0.013)
Number of Obs.	13037	13796	13037	13796
Measured by (3)				
Exp. ER (RE)	-0.004	-0.004	-0.005*	-0.005*
	(0.003)	(0.003)	(0.002)	(0.002)
ER	-0.011	-0.037	0.003	-0.013
	(0.107)	(0.100)	(0.095)	(0.087)
Rel. Wage	-0.068	-0.299**	0.102	-0.394***
	(0.245)	(0.102)	(0.258)	(0.115)
Number of Obs.	2475	2639	2475	2639
Measured by (4)				
Exp. ER (RE)	-0.002	-0.002	-0.003	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
ER	0.213	0.103	0.269*	0.198†
	(0.131)	(0.127)	(0.112)	(0.109)
Rel. Wage	1.063	0.554	3.990***	1.683*
	(0.834)	(0.657)	(1.139)	(0.844)
Number of Obs.	809	809	809	809
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (RE)	-0.004**	-0.004**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
ER	-0.217***	-0.219***	-0.358***	-0.348***
	(0.050)	(0.048)	(0.034)	(0.032)
Rel. Wage	-0.029*	-0.068***	-0.042***	-0.075***
	(0.013)	(0.011)	(0.013)	(0.012)
Number of Obs.	13808	14494	13808	14494

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

Table 3.8 provides the empirical results on the measures of vertical FDI. The negative binomial regression model, favored by the likelihood test and α-statistics, uncovers that the expected exchange rate effect on vertical FDI by all the measures is zero, except for the second measure. The expected exchange rate effect under the second measure of vertical FDI is negative and statistically significant at the 5% level. Interestingly, this is the first statistically significant evidence for the expected exchange rate effect on vertical FDI. The negative effect implies that that the expected depreciation of a host country currency under rational expectation assumption is greater than the threshold level for vertical FDI, so that foreign direct investors postponed vertical FDI.

Nevertheless, the exchange rate effect on vertical FDI under rational expectation is not consistent with the model's prediction under all of the measures. Even though the exchange rate effect on vertical FDI is positive under the fourth measure, it is not statistically significant. Furthermore, the relative wage effect on vertical FDI measured by the fourth measure is incorrectly positive, but it is not statistically significant either. These unsupportive results may ask for a more careful measure of vertical FDI over again. The relative real wage effect on vertical FDI under the other three measures is negative, as predicted by the model. However, the wage effect under the first and the second measure of vertical FDI is statistically significant. The wage effect under the third measure is inconclusive since a Hausman test is unable to tell between the fixed effects and the random effects.

As a result, the empirical results under rational expectation assumption provide zero and a negative expected exchange rate effect on vertical FDI. However, it is difficult to examine whether rational expectations have an effect on the exchange rate effect on vertical FDI because the exchange rate effect on vertical FDI under rational expectation assumption is not supported by the results. Despite that, the empirical results provide enough support for the relative wage effect on vertical FDI.

III.4.4. Risk-Adjusted Rational Expectation

As discussed earlier, rational expectation could be a poor assumption because of imperfect asset substitutability. In order to modify the assumption better, a risk-adjusted rational expectation measure is considered, having controlled for imperfect asset substitutability (see section III.2.1).

Table 3.9 shows the estimation results on the measures of horizontal FDI under risk-adjusted rational expectations assumption. Favored by the likelihood ratio test and α-statistics, the negative binomial regression model reveals that the expected exchange rate effect on horizontal FDI is effectively zero under all of the measures, except for the fourth measure of horizontal FDI. The expected exchange rate effect under the fourth measure is negative and statistically significant at the 10% since a Hausman test favors the random effects. However, the statistical significance may not be convincing because the relative wage effect is unexpectedly positive.

Table 3.9. The Expected Exchange Rate Effect on Horizontal FDI under Risk-Adjusted Rational Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (RRE)	-0.009	-0.007	-0.035***	-0.036***
	(0.009)	(0.009)	(0.005)	(0.005)
ER	-0.712***	-0.701***	-0.872***	-0.841***
	(0.097)	(0.095)	(0.052)	(0.051)
Rel. Wage	-0.497***	-0.717***	0.002	-0.735***
	(0.121)	(0.070)	(0.154)	(0.091)
Number of Obs.	2494	2575	2494	2575
Measured by (2)				
Exp. ER (RRE)	-0.005	0.000	-0.016*	-0.009
	(0.008)	(0.006)	(0.006)	(0.006)
ER	-0.629***	-0.604***	-0.553***	-0.523***
	(0.109)	(0.101)	(0.082)	(0.077)
Rel. Wage	0.154	-0.147*	0.265**	0.015
	(0.119)	(0.074)	(0.093)	(0.071)
Number of Obs.	5530	6195	5530	6195
Measured by (3)				
Exp. ER (RRE)	-0.011	-0.009	-0.033***	-0.035***
	(0.014)	(0.014)	(0.010)	(0.010)
ER	-1.006***	-0.958***	-0.743***	-0.700***
	(0.149)	(0.140)	(0.100)	(0.095)
Rel. Wage	-0.459†	-0.777***	0.565*	-0.632***
	(0.269)	(0.111)	(0.259)	(0.124)
Number of Obs.	2085	2215	2085	2215
Measured by (4)				
Exp. ER (RRE)	-0.02	-0.021†	-0.046***	-0.046***
	(0.013)	(0.013)	(0.006)	(0.006)
ER	-0.973***	-0.961***	-0.999***	-0.996***
	(0.125)	(0.124)	(0.058)	(0.058)
Rel. Wage	0.317	0.404	1.294***	1.311***
	(0.418)	(0.405)	(0.250)	(0.244)
Number of Obs.	752	752	752	752
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (RRE)	-0.007	-0.007	-0.016***	-0.016***
	(0.006)	(0.005)	(0.004)	(0.004)
ER	-0.370***	-0.395***	-0.611***	-0.597***
	(0.069)	(0.067)	(0.043)	(0.042)
Rel. Wage	-0.414***	-0.474***	0.137	-0.340***
	(0.076)	(0.049)	(0.107)	(0.076)
Number of Obs.	6796	7244	6796	7244

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The exchange rate effect on horizontal FDI is negative and statistically significant under all of the measures, and all the effects are greatly strengthened compared to the exchange rate effect without controlling for the expectation of the exchange rate. The coefficient (-1.006) under the third measure implies that 10% increase in the exchange rate would reduce horizontal FDI by about 5.6%, which is 2.1% higher than when the expectation of the exchange rate is not controlled for. In fact, the exchange rate effect on horizontal FDI under risk-adjusted rational expectation assumption is the strongest among the exchange rate effect on horizontal FDI considered so far.

The relative real wage effect on horizontal FDI is negative and statistically significant, except for the fourth measure of horizontal FDI, since a Hausman test favors the random effects under the second measure. The wage effect is also strengthened, controlling for the expectations of the exchange rate.

Thus, the empirical results under risk-adjusted rational expectation assumption provide sufficient evidence supporting the exchange rate effect and the relative wage effect on horizontal FDI, and shows that the expectation of the exchange rate has an influence on the exchange rate effect on horizontal FDI. However the results do not provide the statistically significant evidence for the expected exchange rate effect on horizontal FDI.

Similarly, the expected exchange rate effect on overall FDI under risk-adjusted rational expectation assumption is zero. Given the fact that the expected exchange rate effect on overall FDI under rational expectation assumption is

statistically significant and negative, relative risk on assets across countries seem to play an important role in forming the expectations of the exchange rate. Also, the exchange rate effect and the relative real wage effect on overall FDI are negative and highly statistically significant. Moreover, the exchange rate effect and the wage effect under risk-adjusted rational expectation are greatly improved compared to the effects without controlling for the expectation of the exchange rate (see table 2.6). The improved exchange rate effect gives more supports to the hypothesis that the expectations of the exchange rate have an effect on the exchange rate effect on FDI.

Table 3.10 presents the estimation results on the different measures of vertical FDI under the assumption of risk-adjusted rational expectation. According to the negative binomial regression model, the expected exchange rate effect on vertical FDI measured by the fourth measure only is negative and statistically significant at the 5% level. Although the fixed effects under the first and the third measure of vertical FDI show that the expected exchange rate effect is significant at the 10% level, a Hausman test cannot tell that the fixed effects are preferred under these measures of vertical FDI. The negative expected exchange rate effect on vertical FDI implies that foreign direct investors postponed vertical FDI in light of the expected depreciation of a host country currency.

Table 3.10. The Expected Exchange Rate Effect on Vertical FDI under Risk-Adjusted Rational Expectation.

Measured by (1)				
Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (RRE)	-0.038†	-0.018	-0.046*	-0.033†
	(0.022)	(0.020)	(0.018)	(0.017)
ER	-0.118	-0.338†	-0.156	-0.360*
	(0.203)	(0.188)	(0.184)	(0.169)
Rel. Wage	-1.709**	-1.044**	0.227	-0.674*
	(0.525)	(0.339)	(1.156)	(0.331)
Number of Obs.	845	919	845	919
Measured by (2)				
Exp. ER (RRE)	-0.01	-0.009	-0.017***	-0.016***
	(0.007)	(0.006)	(0.004)	(0.004)
ER	-0.334***	-0.354***	-0.629***	-0.608***
	(0.075)	(0.073)	(0.051)	(0.049)
Rel. Wage	-0.463***	-0.482***	0.030	-0.381***
	(0.081)	(0.053)	(0.126)	(0.083)
Number of Obs.	6400	6906	6400	6906
Measured by (3)				
Exp. ER (RRE)	-0.045†	-0.028	-0.049*	-0.032
	(0.025)	(0.023)	(0.023)	(0.021)
ER	-0.197	-0.397†	-0.141	-0.361
	(0.237)	(0.211)	(0.223)	(0.198)
Rel. Wage	-1.827***	-1.285**	-0.645	-0.892*
	(0.530)	(0.432)	(1.383)	(0.431)
Number of Obs.	762	851	762	851
Measured by (4)				
Exp. ER (RRE)	-0.086*	-0.068*	-0.104**	-0.082**
	(0.035)	(0.033)	(0.032)	(0.030)
ER	0.429	0.102	0.547*	0.173
	(0.276)	(0.257)	(0.253)	(0.240)
Rel. Wage	-2.394	-0.161	2.070	2.655†
	(2.396)	(1.505)	(2.592)	(1.533)
Number of Obs.	348	358	348	358
Before Discriminating Between Horizontal FDI And Vertical FDI				
Exp. ER (RRE)	-0.007	-0.007	-0.016***	-0.016***
	(0.006)	(0.005)	(0.004)	(0.004)
ER	-0.370***	-0.395***	-0.611***	-0.597***
	(0.069)	(0.067)	(0.043)	(0.042)
Rel. Wage	-0.414***	-0.474***	0.137	-0.340***
	(0.076)	(0.049)	(0.107)	(0.076)
Number of Obs.	6796	7244	6796	7244

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

The negative binomial regression model reveals that the exchange rate effect on vertical FDI under risk-adjusted rational expectation assumption is not in favor of the model's prediction. The exchange rate effect under the second measure is statistically significant and negative, which is in a direct contradiction to the model's prediction. Despite lacking support, the empirical results under the fourth measure of vertical FDI show that the explanatory variables finally have correct sign as predicted by the model. Moreover, although the relative wage effect under fourth measure is statistically insignificant, the wage effect on vertical FDI is negative and statistically significant in general.

Accordingly, the empirical results under risk-adjusted rational expectation assumption do not give strong support for a negative expected exchange rate effect and a positive exchange rate effect on vertical FDI. However, the estimation under the fourth measure of vertical FDI show encouraging results on the exchange rate effect on vertical FDI. The results provide strong support for a negative wage effect on vertical FDI in general.

III.4.5. Searching for the Exchange Rate Effect on Vertical FDI

To this point, there has been strong evidence for the exchange rate effect and the relative wage effect on horizontal FDI under all of the assumptions of exchange rate expectations. Also, while considerable support for the relative wage effect on vertical FDI has been found under different exchange rate expectations, it has been very difficult to find support for the exchange rate effect on vertical FDI. Therefore,

this section searches for more concrete evidence for the exchange rate effect on vertical FDI.

As pointed out earlier, unsupportive evidence for the exchange rate effect on vertical FDI may ask for a more careful measure of vertical FDI. Thus, an alternative measure of vertical FDI is considered. As in the second chapter, Indonesia, Malaysia and Philippines are excluded from the host countries of the first measure of vertical FDI because these countries present the weakest link between M&A inflow and FDI inflow (see table 2.2).[64] This measure of vertical FDI is put to use under the assumption of rational expectations because the empirical results under rational expectation provides the most favorable evidence for the expected exchange rate effect and the exchange rate effect on vertical FDI.

Table 3.11 summarizes the estimation results. Preferred by the likelihood ratio test and α-statistics, the negative binomial regression model shows the sign of each explanatory variable is indeed consistent with the model's predictions. The expected exchange rate effect on vertical FDI is zero, and the exchange rate effect on vertical FDI is positive and statistically significant at the 5% level. Moreover, the exchange rate effect is greatly strengthened, compared with the exchange rate effect on vertical FDI measured by this alternative measure without controlling for the expectation of the exchange rate (see table 2.8). The coefficient (0.282) measures 10 % increase in the exchange rate would increase FDI by about 22%, which is 8

[64] In order to improve estimation results, Indonesia, Malaysia and Philippines are excluded from the host countries of the first measure of vertical FDI in the second chapter. This is because these countries have the weakest link between M&A inflow and FDI inflow. See the second chapter for more.

percentage points higher than when the expectation of the exchange rate is not controlled for.

Table 3.11. The Exchange Rate Effect on Vertical FDI, Measured by (1) and by Excluding Indonesia, Malaysia and Philippines under Rational Expectation.

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Exp. ER (RE)	-0.003	-0.003	-0.003	-0.003†
	(0.002)	(0.002)	(0.002)	(0.002)
ER	0.284*	0.282*	0.141	0.203†
	(0.130)	(0.122)	(0.114)	(0.104)
Rel. Wage	-0.234	-0.283**	-0.186	-0.425***
	(0.182)	(0.109)	(0.329)	(0.121)
Number of Obs.	1684	1753	1684	1753

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level. †Significant at the 10% level.

Additionally, the relative wage effect on vertical FDI is negative but statistically significant only under the random effects, but a Hausman test cannot distinguish between the fixed effects and the random effects. Nevertheless, the wage effect under the fixed and random effects is much strengthened, compared with the wage effect on vertical FDI measured by this alternative measure without controlling for the expectation of the exchange rate.[65]

Again, these results are by no means sufficient evidence for the exchange rate effect on vertical FDI. However, it shows that a more careful measure of vertical FDI could expose more concrete evidence for the exchange rate effect on vertical FDI.

[65] The estimation results on this alternative measure of vertical FDI under risk-adjusted rational expectation provides similar results to table 3.11. But the exchange rate effect is statistically significant only under the fixed effects, but a Hausman test cannot tell between the two effects.

In summary, the estimation results under all of the assumptions of exchange rate expectation do not seem to provide a statistically significant effect of exchange rate expectations on FDI. Although there has been a statistically significant negative expected exchange rate effect on horizontal FDI and vertical FDI, the evidence is weak.[66] However, the expectations of the exchange rate shed more light on the exchange rate effect on horizontal FDI and vertical FDI. The estimation results under all of the exchange rate expectation assumptions reports a stronger exchange rate effect on horizontal FDI than when the expectations of the exchange rate are not controlled for.

While a positive exchange rate effect on vertical FDI is difficult to find, an additional analysis shows that a more careful measure of vertical FDI could reveal a strengthened positive exchange rate effect on vertical FDI, controlling for the expectations of the exchange rate. As mentioned before, the negative exchange rate effect on horizontal FDI and the positive exchange rate effect on vertical FDI are similar to Chen *et al.* (2006).

These strengthened exchange rate effects are repeatedly observed under the different exchange rate expectations assumptions. However, the expected exchange rate effects on different types of FDI are not robust under the different assumptions of exchange rate expectations. The expected exchange rate effects under perfect forecast expectation assumption are similar to the effects under adaptive

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[66] A negative expected exchange rate effect on horizontal FDI and vertical FDI is found under rational expectation and risk-adjusted rational expectation. While the negative expected exchange rate effect on horizontal FDI is consistent with Chen et al. (2006), the negative expected exchange rate effect on vertical FDI directly contradict Chen et al. (2006).

expectation, and the expected exchange rate effects under rational expectation assumption are similar to those under risk-adjusted rational expectation assumption. In fact, the expected exchange rate doesn't seem to have significant effects on different types of FDI. This suggests that the exchange rate is a more influential determinant of the allocation of different types of FDI than the expected exchange rate.

The negative effect of the relative real wage on horizontal FDI and vertical FDI is strongly supported by the estimation results under all of the exchange rate expectations assumptions. This negative wage effect is consistent with Campa (1993), Chen *et al.* (2006), and Hanson *et al.* (2005).

III.5. Conclusions

This chapter examines the expected exchange rate effect on different types of FDI—horizontal FDI and vertical FDI—under the various assumptions of exchange rate expectations: Perfect forecast expectation, adaptive expectation, rational expectation and risk-adjusted rational expectation. The empirical results suggest that, although the expectations of the exchange rate under all of the exchange rate expectations sheds more light on the exchange rate effects on different types of FDI, the expected exchange rate effects on different types of FDI are not robust under the different assumptions of exchange rate expectations. In fact, the expected exchange rate does not seem to have significant effects on different types of FDI. This suggests

that the exchange rate is a more influential determinant of the allocation of different types of FDI than the expected exchange rate.

Although the exchange rate effect on vertical FDI can be improved by a more careful measure of vertical FDI, actual real wages of a host and home country and alternative measures of FDI activity, instead of M&A, can also be useful to improve the estimation results.

For further research, more theoretical and empirical studies on the expected exchange rate effects on different types of FDI may be required because it is unclear what is the exact level of a depreciation of a host country currency for horizontal FDI and for vertical FDI, at which a foreign direct investor would postpone his FDI, and how the threshold of the depreciation is determined. More research on the threshold of the depreciation will be able to clarify the expected exchange rate effects, and therefore the exchange rate effects on different types of FDI.

APPENDIX A

DERIVATION OF EQUATIONS IN CHAPTER I

This appendix shows the derivation of equations (11) and (16) in section 3, and equations (18) and (24) in section 4.

Derivation of Equation (11)

Given the inverse demand for final good Y in equations (2) and (3), and the production technology in equation (7), the maximized profit in equation (8) can be written as

A.1. $$\pi = A\bar{Y}^{\delta} + \frac{A}{e}\bar{Y}^{*\delta} - \bar{Y}^{2} - \frac{w^{*}}{e}\bar{Y}^{*2}$$

Differentiating with respect to the real exchange rate (e) gives

A.2. $$\frac{\partial \pi}{\partial e} = -\frac{A}{e^{2}}\bar{Y}^{*\delta} + \frac{w^{*}}{e^{2}}\bar{Y}^{*2}$$

Substituting equation (9),

A.3. $$\frac{\partial \pi}{\partial e} = -\frac{A}{e^{2}}\left(\frac{\delta A}{2w^{*}}\right)^{\frac{\delta}{2-\delta}} + \frac{w^{*}}{e^{2}}\left(\frac{\delta A}{2w^{*}}\right)^{\frac{2}{2-\delta}}$$

By collecting terms and simplifying,

A.4. $$\frac{\partial \pi}{\partial e} = \frac{1}{e^2}\left(\frac{\delta A}{2w^*}\right)^{\frac{\delta}{2-\delta}}\left[\frac{(\delta-2)A}{2}\right] < 0, \text{since } 0 < \delta < 1$$

Thus, equation (11) is obtained.

Derivation of Equation (16)

Given the inverse demand for final good Y in equation (2) and the production technology in equations (12) and (13), the maximized profit in equation (14) can be written as

A.5. $$\pi = A\bar{Y}^{\delta} - \bar{Y}^2 - \frac{w^*}{e}\bar{Y}^2$$

Differentiating with respect to the real exchange rate (e) yields

A.6. $$\frac{\partial \pi}{\partial e} = \delta A\bar{Y}^{\delta-1}\left(\frac{\partial \bar{Y}}{\partial e}\right) - 2\bar{Y}\left(\frac{\partial \bar{Y}}{\partial e}\right) + \frac{w^*}{e^2}\bar{Y}^2 - \frac{w^*}{e}\left[2\bar{Y}\left(\frac{\partial \bar{Y}}{\partial e}\right)\right]$$

By the envelope theorem,

A.7. $$\frac{\partial \pi}{\partial e} = \frac{w^*}{e^2}\bar{Y}^2 > 0$$

Thus, equation (16) is found.

Derivation of Equation (18)

Without engaging in horizontal FDI, it is assumed that the monopolist exports final good Y to Foreign. Then, the market clearing condition becomes

A.8. $$Y + Y^* = \sqrt{L_Y}$$

And, the monopolist's profit (π) in the Home currency becomes,

A.9. $$\pi = P_Y Y + \frac{1}{e} P_Y^* Y^* - L_Y$$

It follows that the profit maximization, subject to equation (A.8.) and the inverse demand for final good Y in equations (2) and (3), yields the following equations.

A.10. $$Y^* = \left(e^{\frac{1}{\delta-1}}\right) Y$$

A.11. $$Y + Y^* = \left(\frac{\delta}{2}\right) Y^{\delta-1}$$

A.12. $$\bar{Y} = (\delta/2)^{\frac{1}{2-\delta}} \left(1 + e^{\frac{1}{\delta-1}}\right)^{\frac{1}{\delta-2}} \text{ and } \bar{Y}^* = \left(e^{\frac{1}{\delta-1}}\right) \bar{Y}$$

Using equation (A.8), (A.11) and (A.12), the profit maximizing level of L_Y is

A.13. $$\bar{L}_Y = (\delta/2)^{\frac{2}{2-\delta}}\left(1 + e^{\frac{1}{\delta-1}}\right)^{\frac{2\delta-2}{\delta-2}}$$

By substituting (A.12) and (A.13) into (A.9) and simplifying, equation (18) is obtained.

Derivation of Equation (24)

Without engaging in vertical FDI, the monopolist needs to produce intermediate input M in Home. Then, equation (12) of the production of the intermediate input is replaced by

A.14. $$M = \sqrt{L_M},$$

where L_M is the labor employed to produce the input M in Home. It follows that the monopolist's profit is

A.15. $$\pi = P_Y Y - L_Y - L_M$$

Subject to the inverse demand for final good Y (2) and the production technology of the good Y (13), the profit maximization yields that the profit maximizing level of Y, L_Y, and L_Y is

A.16. $$\bar{L}_Y = \bar{L}_M = \bar{Y}^2, \text{and } \bar{Y} = \left(\frac{4}{\delta}\right)^{\frac{1}{\delta-2}}$$

By substituting (A.16) into (A.15), equation (24) is found.

APPENDIX B

ESTIMATION RESULTS IN CHAPTER II

This appendix provides the complete estimation results on the exchange rate effect on the different types of FDI.

The Exchange Rate Effect on Horizontal FDI, Measured by (1).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	-0.244**	-0.241**	-0.482***	-0.478***
	(0.076)	(0.075)	(0.042)	(0.041)
Rel. Wage	-0.076***	-0.101***	-0.085***	-0.114***
	(0.018)	(0.016)	(0.020)	(0.018)
1986	0.769***	0.782***	-0.774***	1.352***
	(0.160)	(0.159)	(0.065)	(0.131)
1987	1.155***	1.168***	-0.466***	1.660***
	(0.148)	(0.147)	(0.059)	(0.129)
1988	1.624***	1.635***		2.126***
	(0.138)	(0.137)		(0.126)
1989	2.027***	2.038***	0.343***	2.468***
	(0.129)	(0.129)	(0.048)	(0.125)
1990	2.140***	2.152***	0.417***	2.543***
	(0.127)	(0.126)	(0.048)	(0.125)
1991	2.091***	2.103***	0.290***	2.416***
	(0.130)	(0.129)	(0.049)	(0.126)
1992	1.901***	1.913***	0.144**	2.269***
	(0.128)	(0.127)	(0.048)	(0.125)
1993	1.904***	1.915***	0.162***	2.287***
	(0.129)	(0.128)	(0.047)	(0.125)
1994	2.073***	2.084***	0.355***	2.481***
	(0.126)	(0.125)	(0.046)	(0.124)
1995	2.256***	2.271***	0.578***	2.704***
	(0.126)	(0.125)	(0.044)	(0.124)
1996	2.333***	2.344***	0.677***	2.802***
	(0.128)	(0.127)	(0.044)	(0.124)
1997	2.528***	2.537***	0.879***	3.004***
	(0.126)	(0.125)	(0.042)	(0.123)

The Exchange Rate Effect on Horizontal FDI, Measured by (1). (continued).

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
1998	2.613***	2.624***	0.991***	3.116***
	(0.122)	(0.121)	(0.042)	(0.123)
1999	2.662***	2.673***	1.013***	3.137***
	(0.120)	(0.119)	(0.042)	(0.122)
2000	2.908***	2.918***	1.183***	3.308***
	(0.117)	(0.116)	(0.041)	(0.122)
2001	2.596***	2.607***	0.852***	2.977***
	(0.118)	(0.117)	(0.042)	(0.122)
2002	2.149***	2.158***	0.398***	2.523***
	(0.120)	(0.119)	(0.045)	(0.123)
2003	2.182***	2.191***	0.446***	2.571***
	(0.121)	(0.120)	(0.045)	(0.123)
2004	2.327***	2.336***	0.673***	2.798***
	(0.121)	(0.121)	(0.044)	(0.123)
2005	2.613***	2.620***	0.861***	2.984***
	(0.120)	(0.119)	(0.043)	(0.123)
2006	2.676***	2.685***	0.943***	3.066***
	(0.119)	(0.118)	(0.042)	(0.123)
2007	2.810***	2.820***	1.058***	3.182***
	(0.117)	(0.116)	(0.042)	(0.123)
lnalpha				
Constant				0.980***
				(0.077)
Number of Obs.	4443	4482	4443	4482

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Horizontal FDI, Measured by (2).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	-0.248***	-0.293***	-0.197***	-0.237***
	(0.068)	(0.062)	(0.055)	(0.051)
Rel. Wage	-0.050*	-0.070***	-0.043	-0.063***
	(0.020)	(0.015)	(0.022)	(0.016)
1986	(0.184)	(0.266)	-0.802***	-1.383***
	(0.191)	(0.188)	(0.117)	(0.123)
1987	0.217	0.143	-0.534***	-1.114***
	(0.164)	(0.160)	(0.106)	(0.114)
1988	0.777***	0.689***		-0.578***
	(0.148)	(0.143)		(0.101)
1989	1.339***	1.249***	0.485***	-0.095
	(0.130)	(0.123)	(0.082)	(0.093)
1990	1.434***	1.347***	0.522***	-0.059
	(0.125)	(0.118)	(0.081)	(0.092)
1991	1.660***	1.583***	0.640***	0.062
	(0.124)	(0.117)	(0.081)	(0.092)
1992	1.514***	1.440***	0.497***	-0.081
	(0.121)	(0.114)	(0.079)	(0.091)
1993	1.654***	1.577***	0.616***	0.036
	(0.117)	(0.109)	(0.077)	(0.089)
1994	1.732***	1.654***	0.709***	0.129
	(0.117)	(0.109)	(0.076)	(0.088)
1995	1.939***	1.860***	0.920***	0.338***
	(0.117)	(0.109)	(0.074)	(0.087)
1996	2.008***	1.930***	1.008***	0.428***
	(0.117)	(0.108)	(0.074)	(0.086)
1997	2.160***	2.076***	1.220***	0.638***
	(0.115)	(0.106)	(0.072)	(0.084)
1998	2.328***	2.244***	1.391***	0.809***
	(0.113)	(0.105)	(0.071)	(0.083)
1999	2.556***	2.473***	1.550***	0.969***
	(0.111)	(0.103)	(0.070)	(0.083)
2000	2.663***	2.578***	1.652***	1.071***
	(0.110)	(0.102)	(0.070)	(0.082)
2001	2.349***	2.263***	1.331***	0.747***
	(0.110)	(0.103)	(0.071)	(0.083)
2002	1.932***	1.850***	0.906***	0.323***
	(0.113)	(0.106)	(0.074)	(0.086)
2003	2.054***	1.970***	1.065***	0.482***
	(0.112)	(0.104)	(0.073)	(0.084)
2004	2.237***	2.154***	1.240***	0.658***
	(0.110)	(0.102)	(0.072)	(0.083)

The Exchange Rate Effect on Horizontal FDI, Measured by (2). (continued).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	2.377***	2.290***	1.368***	0.783***
	(0.110)	(0.102)	(0.071)	(0.083)
2006	2.479***	2.396***	1.485***	0.903***
	(0.109)	(0.101)	(0.071)	(0.082)
2007	2.566***	2.481***	1.574***	0.992***
	(0.109)	(0.101)	(0.070)	(0.082)
lnalpha				
Constant				0.751***
				(0.044)
Number of Obs.	15019	15309	15019	15309

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Horizontal FDI, Measured by (3).

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	-0.597***	-0.586***	-0.489***	-0.492***
	(0.117)	(0.113)	(0.082)	(0.080)
Rel. Wage	-0.086**	-0.124***	-0.093*	-0.134***
	(0.030)	(0.024)	(0.039)	(0.026)
1986	1.193***	1.161***	-1.095***	0.204
	(0.235)	(0.232)	(0.121)	(0.178)
1987	1.399***	1.365***	-0.878***	0.421*
	(0.229)	(0.226)	(0.113)	(0.174)
1988	1.878***	1.843***	-0.481***	0.819***
	(0.210)	(0.207)	(0.099)	(0.166)
1989	2.511***	2.476***	0.062	1.361***
	(0.192)	(0.188)	(0.086)	(0.159)
1990	2.431***	2.395***	0.017	1.316***
	(0.194)	(0.189)	(0.087)	(0.160)
1991	2.490***	2.457***		1.299***
	(0.196)	(0.191)		(0.161)
1992	2.196***	2.163***	-0.212*	1.086***
	(0.196)	(0.191)	(0.086)	(0.160)
1993	2.388***	2.355***	-0.068	1.230***
	(0.192)	(0.187)	(0.083)	(0.159)
1994	2.430***	2.396***	0.003	1.301***
	(0.191)	(0.186)	(0.082)	(0.157)
1995	2.691***	2.660***	0.232**	1.532***
	(0.189)	(0.184)	(0.078)	(0.156)
1996	2.702***	2.667***	0.306***	1.605***
	(0.192)	(0.187)	(0.077)	(0.156)
1997	2.988***	2.951***	0.609***	1.907***
	(0.190)	(0.184)	(0.074)	(0.154)
1998	3.065***	3.029***	0.711***	2.009***
	(0.185)	(0.180)	(0.072)	(0.153)
1999	3.158***	3.121***	0.790***	2.088***
	(0.180)	(0.175)	(0.072)	(0.152)
2000	3.392***	3.356***	0.956***	2.253***
	(0.177)	(0.172)	(0.070)	(0.151)
2001	2.975***	2.941***	0.579***	1.878***
	(0.180)	(0.175)	(0.074)	(0.152)
2002	2.591***	2.557***	0.149	1.446***
	(0.182)	(0.177)	(0.079)	(0.154)
2003	2.708***	2.671***	0.349***	1.647***
	(0.185)	(0.180)	(0.076)	(0.153)
2004	2.808***	2.771***	0.459***	1.756***
	(0.184)	(0.179)	(0.075)	(0.154)

The Exchange Rate Effect on Horizontal FDI, Measured by (3). (continued).

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	3.002***	2.961***	0.613***	1.910***
	(0.182)	(0.177)	(0.073)	(0.153)
2006	3.183***	3.145***	0.802***	2.099***
	(0.181)	(0.176)	(0.072)	(0.153)
2007	3.257***	3.221***	0.872***	2.170***
	(0.178)	(0.173)	(0.071)	(0.152)
lnalpha				
Constant				0.845***
				(0.086)
Number of Obs.	3819	3880	3819	3880

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Horizontal FDI, Measured by (4).

Explanatory Variables	Panel Negative Binomial		Panel Poisson	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect
ER	-0.516***	-0.513***	-0.595***	-0.592***
	(0.107)	(0.106)	(0.050)	(0.049)
Rel. Wage	-0.879**	-0.781*	0.119	0.151
	(0.334)	(0.328)	(0.200)	(0.196)
1986	2.309***	2.210***		2.560***
	(0.397)	(0.390)		(0.299)
1987	2.561***	2.463***	0.263**	2.823***
	(0.391)	(0.385)	(0.080)	(0.298)
1988	3.139***	3.042***	0.741***	3.301***
	(0.373)	(0.367)	(0.074)	(0.296)
1989	3.566***	3.469***	1.098***	3.658***
	(0.370)	(0.363)	(0.070)	(0.295)
1990	3.648***	3.551***	1.162***	3.722***
	(0.370)	(0.364)	(0.069)	(0.296)
1991	3.574***	3.475***	1.018***	3.577***
	(0.376)	(0.370)	(0.071)	(0.296)
1992	3.436***	3.336***	0.892***	3.452***
	(0.376)	(0.370)	(0.070)	(0.296)
1993	3.404***	3.304***	0.903***	3.463***
	(0.381)	(0.375)	(0.070)	(0.296)
1994	3.531***	3.430***	1.075***	3.635***
	(0.382)	(0.376)	(0.068)	(0.295)
1995	3.743***	3.642***	1.307***	3.867***
	(0.382)	(0.375)	(0.067)	(0.295)
1996	3.858***	3.756***	1.420***	3.980***
	(0.382)	(0.376)	(0.066)	(0.295)
1997	3.962***	3.860***	1.608***	4.168***
	(0.384)	(0.377)	(0.065)	(0.294)
1998	4.095***	3.993***	1.740***	4.299***
	(0.383)	(0.376)	(0.065)	(0.295)
1999	4.161***	4.060***	1.756***	4.316***
	(0.380)	(0.374)	(0.065)	(0.295)
2000	4.283***	4.182***	1.868***	4.428***
	(0.379)	(0.373)	(0.064)	(0.295)
2001	4.031***	3.930***	1.562***	4.121***
	(0.378)	(0.372)	(0.065)	(0.295)
2002	3.533***	3.432***	1.105***	3.664***
	(0.381)	(0.374)	(0.068)	(0.295)
2003	3.580***	3.479***	1.164***	3.724***
	(0.382)	(0.376)	(0.068)	(0.295)
2004	3.692***	3.591***	1.414***	3.974***
	(0.383)	(0.376)	(0.066)	(0.295)

The Exchange Rate Effect on Horizontal FDI, Measured by (4). (continued).

Explanatory Variables	Panel Negative Binomial		Panel Poisson	
	Fixed Effect	Random Effect	Fixed Effect	Random Effect
2005	3.952***	3.853***	1.548***	4.108***
	(0.374)	(0.368)	(0.066)	(0.294)
2006	3.956***	3.856***	1.601***	4.160***
	(0.375)	(0.369)	(0.065)	(0.294)
2007	4.048***	3.949***	1.697***	4.257***
	(0.373)	(0.366)	(0.065)	(0.294)
lnalpha Constant				0.485**
				(0.184)
Number of Obs.	852	852	852	852

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Vertical FDI, Measured by (1).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.006	-0.039	0.01	-0.015
	(0.086)	(0.082)	(0.069)	(0.066)
Rel. Wage	-0.186	-0.279***	0.254	-0.280**
	(0.158)	(0.084)	(0.185)	(0.103)
1986	-2.920***	-2.901***	(0.388)	-3.727***
	(0.717)	(0.716)	(0.764)	(0.591)
1987	-1.851***	-1.822***	0.301	-3.035***
	(0.429)	(0.427)	(0.646)	(0.430)
1988	-2.377***	-2.342***		-3.335***
	(0.594)	(0.592)		(0.519)
1989	-1.086***	-1.051***	1.435**	-1.886***
	(0.304)	(0.300)	(0.542)	(0.253)
1990	-1.052***	-1.024**	1.453**	-1.880***
	(0.318)	(0.314)	(0.550)	(0.267)
1991	-0.221	-0.19	2.290***	-1.041***
	(0.279)	(0.275)	(0.530)	(0.227)
1992	-0.471	-0.426	2.229***	-1.081***
	(0.279)	(0.274)	(0.524)	(0.218)
1993	0.2	0.234	2.906***	-0.407*
	(0.223)	(0.216)	(0.510)	(0.181)
1994	0.563**	0.595**	3.285***	-0.03
	(0.211)	(0.204)	(0.507)	(0.172)
1995	0.834***	0.876***	3.352***	0.045
	(0.214)	(0.205)	(0.509)	(0.184)
1996	0.925***	0.970***	3.552***	0.246
	(0.220)	(0.211)	(0.508)	(0.179)
1997	1.095***	1.127***	3.811***	0.503**
	(0.197)	(0.188)	(0.505)	(0.167)
1998	1.481***	1.517***	4.111***	0.803***
	(0.191)	(0.182)	(0.504)	(0.165)
1999	1.551***	1.591***	4.196***	0.888***
	(0.206)	(0.196)	(0.504)	(0.171)
2000	1.473***	1.506***	4.157***	0.847***
	(0.193)	(0.184)	(0.504)	(0.165)
2001	1.380***	1.405***	4.017***	0.704***
	(0.187)	(0.178)	(0.504)	(0.162)
2002	0.975***	1.002***	3.736***	0.425**
	(0.197)	(0.189)	(0.505)	(0.164)
2003	1.300***	1.323***	4.072***	0.760***
	(0.190)	(0.182)	(0.503)	(0.159)
2004	1.646***	1.674***	4.384***	1.075***
	(0.187)	(0.178)	(0.503)	(0.158)

The Exchange Rate Effect on Vertical FDI, Measured by (1). (continued).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	1.619***	1.645***	4.408***	1.096***
	(0.190)	(0.182)	(0.503)	(0.157)
2006	1.643***	1.662***	4.410***	1.102***
	(0.196)	(0.188)	(0.503)	(0.158)
2007	1.293***	1.304***	4.202***	0.888***
	(0.211)	(0.204)	(0.506)	(0.165)
lnalpha				
Constant				0.707***
				(0.096)
Number of Obs.	3089	3203	3089	3203

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Vertical FDI, Measured by (2).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	-0.074	-0.107*	-0.179***	-0.186***
	(0.050)	(0.048)	(0.035)	(0.033)
Rel. Wage	-0.031*	-0.065***	-0.042**	-0.071***
	(0.013)	(0.011)	(0.013)	(0.012)
1986	-0.285*	-0.278*	-1.351***	-0.530***
	(0.130)	(0.129)	(0.065)	(0.085)
1987	0.133	0.139	-1.001***	-0.180*
	(0.115)	(0.113)	(0.056)	(0.080)
1988	0.699***	0.701***	-0.426***	0.396***
	(0.101)	(0.099)	(0.047)	(0.074)
1989	1.028***	1.024***	-0.140**	0.681***
	(0.093)	(0.091)	(0.043)	(0.071)
1990	1.182***	1.179***	-0.034	0.787***
	(0.089)	(0.087)	(0.042)	(0.070)
1991	1.466***	1.471***		0.822***
	(0.087)	(0.085)		(0.071)
1992	1.361***	1.368***	-0.112**	0.710***
	(0.084)	(0.082)	(0.041)	(0.070)
1993	1.392***	1.394***	-0.082*	0.738***
	(0.082)	(0.080)	(0.040)	(0.070)
1994	1.534***	1.537***	0.121**	0.942***
	(0.082)	(0.080)	(0.038)	(0.069)
1995	1.672***	1.676***	0.286***	1.106***
	(0.082)	(0.080)	(0.037)	(0.069)
1996	1.706***	1.709***	0.360***	1.181***
	(0.082)	(0.080)	(0.037)	(0.068)
1997	1.833***	1.830***	0.510***	1.329***
	(0.080)	(0.078)	(0.036)	(0.068)
1998	2.056***	2.055***	0.700***	1.520***
	(0.078)	(0.076)	(0.035)	(0.067)
1999	2.165***	2.164***	0.763***	1.583***
	(0.078)	(0.075)	(0.035)	(0.067)
2000	2.366***	2.364***	0.938***	1.757***
	(0.076)	(0.074)	(0.034)	(0.067)
2001	2.163***	2.161***	0.665***	1.483***
	(0.076)	(0.074)	(0.035)	(0.067)
2002	1.629***	1.629***	0.157***	0.976***
	(0.078)	(0.076)	(0.038)	(0.069)
2003	1.672***	1.671***	0.192***	1.011***
	(0.078)	(0.076)	(0.038)	(0.068)
2004	1.885***	1.883***	0.463***	1.282***
	(0.077)	(0.075)	(0.036)	(0.067)

The Exchange Rate Effect on Vertical FDI, Measured by (2). (continued).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	2.144***	2.140***	0.658***	1.475***
	(0.076)	(0.073)	(0.035)	(0.067)
2006	2.125***	2.123***	0.671***	1.490***
	(0.076)	(0.074)	(0.035)	(0.067)
2007	2.249***	2.248***	0.788***	1.607***
	(0.075)	(0.073)	(0.035)	(0.067)
Inalpha				
Constant				0.917***
				(0.039)
Number of Obs.	17368	17663	17368	17663

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Vertical FDI, Measured by (3).

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.037	-0.021	0.089	0.058
	(0.102)	(0.095)	(0.084)	(0.078)
Rel. Wage	0.052	-0.202*	0.365	-0.213
	(0.240)	(0.098)	(0.212)	(0.123)
1986	-3.439***	-3.413***	-3.495***	-4.848***
	(1.011)	(1.009)	(1.020)	(1.009)
1987	-2.352***	-2.315***	-2.412***	-3.764***
	(0.599)	(0.596)	(0.610)	(0.595)
1988	-2.199***	-2.154***	-2.041***	-3.391***
	(0.601)	(0.597)	(0.537)	(0.522)
1989	-1.367***	-1.320***	-1.084**	-2.421***
	(0.377)	(0.370)	(0.332)	(0.310)
1990	-1.294***	-1.259**	-1.032**	-2.381***
	(0.389)	(0.383)	(0.350)	(0.325)
1991	-0.207	-0.172		-1.345***
	(0.310)	(0.302)		(0.253)
1992	-0.425	-0.367	0.004	-1.321***
	(0.310)	(0.300)	(0.260)	(0.239)
1993	0.088	0.132	0.448	-0.880***
	(0.260)	(0.248)	(0.231)	(0.207)
1994	0.515*	0.558*	0.899***	-0.430*
	(0.242)	(0.229)	(0.221)	(0.193)
1995	0.684**	0.739**	0.906***	-0.414*
	(0.252)	(0.238)	(0.226)	(0.211)
1996	0.808**	0.868***	1.106***	-0.213
	(0.257)	(0.243)	(0.220)	(0.204)
1997	0.923***	0.963***	1.366***	0.043
	(0.235)	(0.220)	(0.212)	(0.188)
1998	1.402***	1.449***	1.719***	0.398*
	(0.224)	(0.210)	(0.208)	(0.185)
1999	1.439***	1.486***	1.789***	0.467*
	(0.243)	(0.228)	(0.208)	(0.192)
2000	1.403***	1.443***	1.807***	0.483**
	(0.228)	(0.214)	(0.207)	(0.185)
2001	1.250***	1.282***	1.583***	0.255
	(0.220)	(0.206)	(0.209)	(0.182)
2002	0.812***	0.847***	1.278***	-0.048
	(0.234)	(0.221)	(0.212)	(0.185)
2003	1.118***	1.147***	1.625***	0.299
	(0.228)	(0.215)	(0.208)	(0.179)
2004	1.487***	1.522***	1.916***	0.592***
	(0.222)	(0.208)	(0.205)	(0.176)

The Exchange Rate Effect on Vertical FDI, Measured by (3). (continued).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	1.549***	1.580***	2.011***	0.683***
	(0.223)	(0.209)	(0.204)	(0.175)
2006	1.520***	1.543***	2.035***	0.711***
	(0.233)	(0.219)	(0.207)	(0.176)
2007	1.168***	1.177***	1.744***	0.412*
	(0.251)	(0.240)	(0.219)	(0.187)
lnalpha Constant				0.690***
				(0.102)
Number of Obs.	2830	2968	2830	2968

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Vertical FDI, Measured by (4).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.147	0.08	0.264*	0.236*
	(0.125)	(0.121)	(0.105)	(0.101)
Rel. Wage	1.765**	1.265*	5.748***	3.738***
	(0.662)	(0.546)	(0.883)	(0.747)
1986	-3.198**	-3.081**	0.027	-3.520***
	(1.015)	(1.014)	(1.001)	(0.744)
1987	-1.707***	-1.564**	0.873	-2.668***
	(0.498)	(0.494)	(0.837)	(0.509)
1988	-2.536***	-2.380**		-3.536***
	(0.744)	(0.741)		(0.750)
1989	-1.757***	-1.579***	1.089	-2.335***
	(0.480)	(0.473)	(0.762)	(0.395)
1990	-0.917*	-0.775*	1.975**	-1.548***
	(0.390)	(0.386)	(0.750)	(0.351)
1991	-0.738	-0.588	1.994**	-1.520***
	(0.387)	(0.384)	(0.750)	(0.359)
1992	-1.082**	-0.894*	1.930**	-1.475***
	(0.411)	(0.402)	(0.733)	(0.338)
1993	-0.277	-0.094	2.575***	-0.852**
	(0.337)	(0.326)	(0.720)	(0.305)
1994	-0.007	0.181	2.853***	-0.58
	(0.328)	(0.315)	(0.718)	(0.297)
1995	0.15	0.352	2.892***	-0.523
	(0.334)	(0.320)	(0.718)	(0.307)
1996	0.431	0.632*	3.235***	-0.197
	(0.333)	(0.319)	(0.716)	(0.303)
1997	0.338	0.523	3.258***	-0.17
	(0.317)	(0.304)	(0.715)	(0.292)
1998	0.887**	1.073***	3.686***	0.258
	(0.304)	(0.291)	(0.713)	(0.286)
1999	1.077***	1.276***	3.853***	0.417
	(0.323)	(0.310)	(0.712)	(0.293)
2000	0.831**	1.024***	3.570***	0.14
	(0.313)	(0.300)	(0.713)	(0.292)
2001	0.651*	0.842**	3.444***	0.023
	(0.312)	(0.298)	(0.714)	(0.290)
2002	0.151	0.344	2.989***	-0.433
	(0.327)	(0.313)	(0.716)	(0.296)
2003	0.59	0.783**	3.467***	0.048
	(0.316)	(0.301)	(0.714)	(0.288)
2004	0.873**	1.073***	3.744***	0.335
	(0.319)	(0.303)	(0.713)	(0.290)

The Exchange Rate Effect on Vertical FDI, Measured by (4). (continued).

Explanatory Variables	Negative Binomial		Poisson	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	0.696*	0.905**	3.639***	0.234
	(0.330)	(0.313)	(0.713)	(0.292)
2006	0.732*	0.936**	3.776***	0.385
	(0.333)	(0.317)	(0.713)	(0.291)
2007	0.592	0.778*	3.662***	0.262
	(0.342)	(0.327)	(0.716)	(0.293)
lnalpha				
Constant				0.506**
				(0.189)
Number of Obs.	877	877	877	877

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

The Exchange Rate Effect on Vertical FDI, Measured by (1) and Excluding Indonesia, Malaysia and Philippines.

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
ER	0.229	0.188	0.248**	0.227**
	(0.121)	(0.114)	(0.092)	(0.087)
Rel. Wage	-0.087	-0.237*	0.32	-0.245
	(0.209)	(0.104)	(0.222)	(0.136)
1986	-3.285**	-3.270**	-1.880*	-3.749***
	(1.011)	(1.009)	(0.761)	(0.726)
1987	-2.682***	-2.658***	-1.925*	-3.790***
	(0.727)	(0.724)	(0.760)	(0.727)
1988	-15.359	-28.786	-16.056	-21.806
	(396.026)	(331000.000)	(818.203)	(5718.801)
1989	-1.458***	-1.426***	-0.145	-1.982***
	(0.400)	(0.393)	(0.369)	(0.305)
1990	-2.185***	-2.163***	-0.68	-2.539***
	(0.600)	(0.596)	(0.469)	(0.415)
1991	-1.170**	-1.142**		-1.852***
	(0.421)	(0.415)		(0.333)
1992	-0.803*	-0.761*	0.615	-1.213***
	(0.327)	(0.316)	(0.321)	(0.252)
1993	-0.339	-0.307	1.176***	-0.655**
	(0.303)	(0.292)	(0.303)	(0.229)
1994	0.149	0.179	1.615***	-0.219
	(0.267)	(0.255)	(0.294)	(0.213)
1995	0.461	0.505*	1.628***	-0.197
	(0.270)	(0.254)	(0.296)	(0.229)
1996	0.406	0.452	1.740***	-0.086
	(0.294)	(0.279)	(0.296)	(0.230)
1997	0.647*	0.682**	2.096***	0.269
	(0.264)	(0.249)	(0.289)	(0.214)
1998	1.198***	1.231***	2.486***	0.658**
	(0.244)	(0.230)	(0.285)	(0.208)
1999	1.254***	1.282***	2.548***	0.721***
	(0.249)	(0.235)	(0.285)	(0.210)
2000	1.242***	1.274***	2.539***	0.714***
	(0.240)	(0.225)	(0.285)	(0.207)
2001	1.183***	1.211***	2.430***	0.604**
	(0.234)	(0.220)	(0.285)	(0.204)
2002	0.891***	0.919***	2.222***	0.397
	(0.239)	(0.225)	(0.287)	(0.204)
2003	1.144***	1.167***	2.519***	0.695***
	(0.235)	(0.222)	(0.285)	(0.200)
2004	1.459***	1.488***	2.831***	1.009***
	(0.237)	(0.222)	(0.283)	(0.199)

The Exchange Rate Effect on Vertical FDI, Measured by (1) and Excluding Indonesia, Malaysia and Philippines. (continued).

Explanatory	Negative Binomial		Poisson	
Variables	Fixed Effects	Random Effects	Fixed Effects	Random Effects
2005	1.371***	1.400***	2.815***	0.992***
	(0.242)	(0.226)	(0.283)	(0.198)
2006	1.533***	1.558***	2.892***	1.071***
	(0.241)	(0.226)	(0.283)	(0.197)
2007	1.156***	1.173***	2.699***	0.876***
	(0.267)	(0.253)	(0.290)	(0.207)
lnalpha				
Constant				0.727***
				(0.120)
Number of Obs.	1983	2002	1983	2002

Note: Standard errors are in parentheses. *Significant at the 5% level; **Significant at the 1% level; ***Significant at the 0.1% level.

APPENDIX C

ESTIMATION RESULTS IN CHAPTER III

The complete estimation results on the effect of the expected exchange rate and the exchange rate effect on the different types of FDI in the third chapter are available upon request.

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