ผลกระทบจากความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนโดยตรงและเงินลงทุนในกลุ่มหลักทรัพย์จากต่างประเทศที่ไหลเข้าสู่ประเทศไทย

นางสาว ชนนิกานต์ อรัญรัตน์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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ปีการศึกษา 2554

THE EFFECT OF EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT AND PORTFOLIO FLOWS TO THAILAND

Miss Chonnikarn Aranyarat

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Science Program in Finance

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ชนนิกานต์ อรัญรัตน์: ผลกระทบจากความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนโดยตรงและเงินลงทุนในกลุ่มหลักทรัพย์จากต่างประเทศที่ไหลเข้าสู่ประเทศไทย. (THE EFFECT OF EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT AND PORTFOLIO FLOWS TO THAILAND) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ดร. อนิรุต พิเสฏฐศลาศัย, 67 หน้า.

วิทยานิพนธ์ฉบับนี้จัดทำขึ้นเพื่อศึกษาผลกระทบจากการเปลี่ยนแปลงและความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนโดยตรงโดยรวม เงินลงทุนโดยตรงในแต่ละรายอุตสาหกรรม และเงินลงทุนในกลุ่มหลักทรัพย์ในแต่ละรายบริษัทจากต่างประเทศที่ไหลเข้าสู่ประเทศไทย ตัวแปรที่ใช้ในการศึกษาผลกระทบจากการเปลี่ยนแปลงและความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนโดยตรง เป็นข้อมูลอนุกรมเวลา ซึ่งครอบคลุมระยะเวลาตั้งแต่ปี 2544 ถึง ปี 2552 ผลลัพธ์ที่ได้นั้นสามารถสรุปได้ว่าการเปลี่ยนแปลง ของอัตราแลกเปลี่ยนมีผลต่อเงินลงทุนโดยตรงโดยรวม และเงินลงทุนที่เข้ามาลงทุนในอุตสาหกรรมเครื่องจักรและอุปกรณ์ขนส่ง โลหะและอโลหะ เคมีภัณฑ์ สิ่งทอ สถาบันการเงิน และการลงทุนและบริษัทโฮลดิ้ง ในส่วนของความผันผวนของอัตราแลกเปลี่ยน ผลกระทบเกิดขึ้นต่อเงินลงทุนโดยตรงในอุตสาหกรรมเครื่องจักรและอุปกรณ์ขนส่ง เคมีภัณฑ์ อาหารและน้ำตาล สถาบันการเงิน เหมืองแร่และย่อยหิน ผลิตภัณฑ์น้ำมัน อสังหาริมทรัพย์ และบริการ ผลการศึกษานั้นเป็นไปตามที่คาดการณ์และสามารถสรุปได้ว่า ผลกระทบจากการเปลี่ยนแปลงและความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนโดยตรงที่ไหลเข้าในแต่ละรายอุตสาหกรรมแตกต่างกัน เนื่องจากความเสี่ยงของแต่ละอุตสาหกรรมต่อการเปลี่ยนแปลงและ ความผันผวนของอัตราแลกเปลี่ยนนั้นแตกต่างกัน

สำหรับเงินลงทุนในกลุ่มหลักทรัพย์ การศึกษา นี้ใช้ตัวแปรที่เป็นข้อมูลตัดขวางทางยาว ครอบคลุมระยะเวลาตั้งแต่ปี 2548 ถึง ปี 2552 เพื่อศึกษาถึง ผลกระทบจากการเปลี่ยนแปลง และ ความผันผวนของอัตราแลกเปลี่ยนต่อเงินลงทุนในกลุ่มหลักทรัพย์ที่ไหลเข้าสู่ประเทศไทยในแต่ละรายบริษัท ผลการศึกษาแสดงให้เห็นว่า การแข็งค่าของเงินบาทส่งผลให้ เงินลงทุนในกลุ่มหลักทรัพย์ไหลเข้าสู่ประเทศไทยมากขึ้น นอกจากนี้ความสัมพันธ์ระหว่างความผันผวนของอัตราแลกเปลี่ยนและเงินลงทุนในกลุ่มหลักทรัพย์ที่ไหลเข้าสู่ประเทศไทยนั้นเป็นไปในเชิงลบ โดยความสัมพันธ์นี้สามารถอธิบายได้ว่า ความผันผวนของอัตราแลกเปลี่ยน ส่งผลให้การไหลเข้าของเงินลงทุนในกลุ่มหลักทรัพย์ในแต่ละรายบริษัทลดลง

ภาควิชา การธนาคารและการเงิน ลายมือชื่อนิสิต .....

สาขาวิชา การเงิน ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

ปีการศึกษา 2554

538 20650 26: MAJOR FINANCE
KEYWORDS: EXCHANGE RATE VOLATILITY / FOREIGN DIRECT INVESTMENT / PORTFOLIO FLOWS

CHONNIKARN ARANYARAT: THE EFFECT OF EXCHANGE RATE VOLATILITY ON FOREIGN DIRECT INVESTMENT AND PORTFOLIO FLOWS TO THAILAND. ADVISOR: ANIRUT PISEDTASALASAI, Ph.D., 67 pp.

This paper aims to examine the question of whether exchange rate movements and exchange rate risk impact the overall flows of foreign direct investment (FDI), FDI at sector level, and portfolio flows at firm-specific level to Thailand. To analyze the effect on FDI, this paper conducts a time-series model by regressing the exchange rate movements and exchange rate risk on the overall FDI and FDI at industry level. The result, based on monthly data from 2001 to 2009, suggest that exchange rate movements influence the aggregate FDI, machinery and transportation equipment, chemicals, textiles, finance institutions, and investment sectors. The exchange rate risk is statistically significant for machinery and transportation equipment, chemicals, food and sugar, finance institutions, mining and quarry, petroleum products, and services industries. As expected, FDI responsiveness to exchange rate movements and exchange rate risk varies across industries as different industries expose to exchange rate movements and exchange rate risk differently.

For the link between exchange rate movements, exchange rate risk and foreign portfolio flows to Thailand. This study employs panel data analysis in order to estimate the model of foreign portfolio investment at firm-level. Based on the monthly data covering the period 2005 to 2009, the results reveal that appreciation of THB against other currencies in the bundle raises the firm-specific foreign portfolio inflows to Thailand. Regarding the exchange rate risk, the link between exchange rate risk and foreign portfolio investment is negative indicating that high exchange rate risk lowers firm-specific foreign portfolio flows to Thailand.

Department: Banking and Finance Student's Signature .....

Field of Study: Finance Advisor's Signature .....

Academic Year: 2011

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CONTENTS

Page

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

1.1 Background and Problem Review

Since the world has moved towards higher financial integration, a degree of openness for international investments in several countries becomes higher. As both developed and emerging economies continue to open their markets to attract foreign capital flows and investors are becoming interested in diversifying their fund flows internationally, the role of foreign investment flows is increasingly important.

A renewed interest by international investors in direct investment like investing in long term projects and portfolio investment such as making a purchase or sale of financial assets across countries during a recent decade increases the emphasis of both foreign direct investment (FDI) and portfolio investment. Considering the major determinants of foreign investment, exchange rate movements as well as exchange rate risk are possibly recognized as the most important determinants of foreign investment flows. The exchange rate movements is taken into consideration as the key issues facing foreign investors simply because exchange rate movements could possibly generate both negative and positive effects on the level of foreign investment. Campa and Goldberg (1999) reveal that exchange rate movements impact firms' investment through three channels. Firstly, a depreciation of local currency increases domestic prices, in respond to a rise in competing imported goods. This increase in price then decreases the revenue as well as wealth, and eventually negatively affects the firms' profitability and investment level. Secondly, a depreciation of domestic currency lowers the domestic currency value of domestic exports in terms of foreign export price, thereby expanding the volume and revenue of exporting activities and finally enhancing the level of investment. The last channel is described by imported input channel. Real domestic currency depreciation increases domestic costs of imported intermediate inputs and this then reduces the marginal profitability and the level of investment.

The exchange rate risk is also drawn an attention from numerous studies. From a theoretical point of view, Phillips et al (2008) discover that the linkage between exchange rate risk and FDI can be classified into two main approaches consisting of production flexibility and risk aversion. Referring to production flexibility approach, it is stated that manufacturers commit to local and foreign capacity ex ante and commit to employment

decisions ex post, after the realization of real shocks. Thus, the movements of exchange rate play no role in explaining the level of FDI. This argument is based on the assumption that firms can adjust their variable factors after the realization of exchange rate shocks; as a consequence, it would not be held if factors were fixed.

Under the risk aversion approach, the empirical evidence could possibly be categorized into two main aspects. The first impact is derived from exchange rate steadiness. A stability of dollar corresponded with a rise in the level of total investment inflow suggests that international investments would be driven partly by variability of exchange rate. The study of Foad (2005) demonstrates that under the condition of limited potential direct investment, FDI flows from the countries with high level of exchange rate risk into the countries with higher stability in currency. This conclusion is consistent with Dixit and Pindyck (1994) who find that FDI in a country with a high level of currency risk provides an uncertain stream of expected return on investment; as a result, the relation between FDI and exchange rate stability is positive.

Another impact can be obtained through the marginal revenue and cost channels. In other words, it focuses on the impact of exchange rate on differentiating investment decision based on the loss and profitability from investment. Goldberg and Kolstad (1995) explain that higher volatility in the exchange rate lowers the expected profit functions of firms that make investment decisions in the current period in order to realize profits in future periods. Campa (1993) extends this study to risk neutral firms by using the approach of future expected profits. He finally summarizes that risk neutral firms tend to postpone their decision to enter the foreign markets in case of high exchange rate variability. Nucci and Pozzolo (1999) report that currency depreciation stimulates aggregate investment responses for Italian manufacturing firms through revenue channel and disincentive investment via cost channel.

These existing evidences indicates that even though several literatures have been emphasized on the relation between exchange rate movements, exchange rate risk, and FDI, they cannot yet provide the clear-cut conclusion on the impacts of exchange rate movements and exchange rate risk on FDI.

As for portfolio investment flows, prior literatures have also explored both negative as well as positive relationship between exchange rate movements, exchange rate risk, and portfolio investment.

Regarding the exchange rate movements, based on the assumption of imperfect capital markets, Froot and Stein (1991) found out that currency depreciation in host country increases the wealth of foreigners, thereby allowing them to make higher purchases for more assets. This then shifts aggregate portfolio investment demands.

Muller and Verschoor (2009) reveal that a climate of exchange rate plays a crucial role in changes in relative values of domestic and foreign assets and liabilities, thereby varying the level of foreign portfolio investment flows.

With regard to exchange rate risk, because exchange rate risk influences wealth across multinational investors; therefore, exchange rate risk is also taken into account when foreign portfolio investors make investment decision. The related researches report that exchange rate risk is counted as another additional risk that affects portfolio investment decisions. Gourinchas and Rey (2005) indicate that the variation of exchange rate affects the U.S. economy both through trade channel as well as gains and losses on U.S. financial assets valuation.

Some empirical studies also report the significant relation of exchange rate risk and portfolio investment. Carrieri and Majerbi (2006) reports that in foreign investors' view, currency risk are taken into account as another source of nondiversifiable risk made foreign investment riskier relative to domestic investment. Thus, higher degree of exchange rate risk then lowers the foreign investment.

Eun and Resnick (1988) reveal that exchange rate risk leads to the higher degree of portfolio risk. However, the exchange rate risk is considerably valuable to multinational investors due to its capability to capture the potential gains from international diversification. Therefore, it can be concluded from their studies that exchange rate risk brings about both negative and positive impact on portfolio investment.

Obviously seen from these abovementioned literatures, the relationship between exchange rate, exchange rate risk, and portfolio investment is still ambiguous though this research topic has long been mentioned.

This paper distinguishes itself by several ways. First of all, this paper examines the impact of exchange rate movements and exchange rate risk on the overall level of FDI to Thailand. Furthermore, based on the believe that the effect of exchange rate movements and exchange rate risk on FDI in each industry, especially FDI in nonmanufacturing categories

would be different from the overall FDI, this significant point then therefore leads to another contribution that is subsequently explained.

Secondly, this study extends previous researches by analyzing the impact of exchange rate movements and exchange rate risk on sectoral FDI in Thailand in order to clearly understand how the exchange rate movements and exchange rate risk would differently affect the inflows of FDI at industry-level in Thailand. By doing this, this study uses FDI at sector-level in Thailand as a sample set based on the belief that international direct investment responsiveness to exchange rate movements and exchange rate risk distinguishes across industries as different industries might differently expose to exchange rate movements and exchange rate risk. FDI in manufacturing categories are likely to be affected by exchange rate movements and exchange rate risk as similar as the overall FDI flows. However, FDI in nonmanufacturing category tend to be dissimilarly influenced by exchange rate movements and exchange rate risk compared to FDI at the overall level. This can be explained by the nature of industries in the sense that industries that mainly operate in global market such as machinery and transportation equipment, and food and beverages should be more strongly sensitive to exchange rate movements and exchange rate risk than those industries like real estate that purely perform in domestic environment. Hence, this paper expects that the overall FDI and FDI in manufacturing category would be similarly impacted by exchange rate movements and exchange rate risk; nevertheless, the impact of exchange rate movements and exchange rate risk are predicted to be different on the overall flows of FDI and FDI in nonmanufacturing category.

Last of all, aside from those previous literatures that principally analyze the relation of exchange rate movements and exchange rate risk on the aggregate portfolio investment, this paper additionally sheds further light from the prior works on the direction of individual firm-specific portfolio investment represented by monthly transactions of company-specific aggregate foreign trading values in response to exchange rate movements and exchange rate risk in order to find out the different effects among different characteristics of each individual firm by using firm-level panel data method.

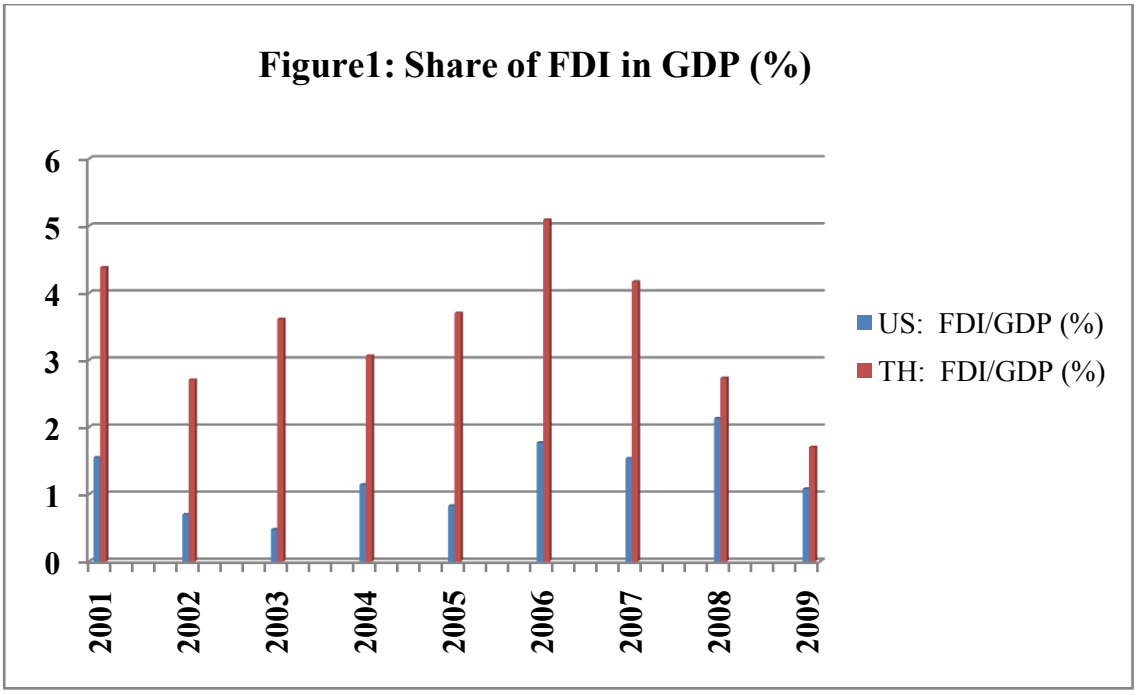
An important advantage of using microeconomic panel data technique (Greene 2000) is that it allows the researcher far greater flexibility in computing differences in behavior across individual and unobservable individual fixed effects could be controlled. Even though unmeasured, these particular idiosyncrasies mirror specific features of each firm, which are

influential in investment decision. The fixed effects in panel data method provide the ability to control for individual firm's idiosyncratic characteristics as well as to model their differences. As a consequence, a large proportion of biasness in the estimates can be reduced when fixed effects are included in the specification for panel data. In this study, I select firms' size, market to book value, stock return, and beta of each individual firm as firms' particular characteristics on the ground that foreign investors generally prefer moving their fund flows into firms with large market capitalization, low market to book ratio, high securities' return, and low CAPM beta according to Eva and Anders (2005), Miyajima and Yafeh (2007), and Capital Asset Pricing Model (CAPM). Therefore, the expected empirical result from this section is that the portfolio investment reaction to exchange rate movements and exchange rate risk is unpredictable as it varies with firm specific- characteristics.

As for country identification, Thailand provides an excellent case for examining this issue due to several aspects. First of all, according to monetary framework, Thailand has adopted the managed-float exchange rate regime[1] which is distinct from the system of free float exchange rate in most developed countries since July 1997. Hence, both direct and indirect investment flows into Thailand should be less likely affected by the exchange rate movement and exchange rate risk compared to those develop countries such as USA, German, Japan, and the UK. Besides, referring to the statistics shown in Figure 1, Thailand has larger size of share of FDI inflow in GDP when compared to the US. This implies that Thailand economy is proportionally dependent on the inflows of FDI; therefore, it is of interest to investigate that whether or not exchange rate movements and exchange rate risk determine the inflows of FDI to Thailand.

Apart from that, there are some investment conditions such as the law of capital market regulation and other limitations for international portfolio investments; for instance, foreign equity investment is generally allowed to participate up to 49% in Thai listed companies, according to the Foreign Business Act (1999). These regulation and limitations restrict the foreign capital flows into Thailand; resulting in a decline in the degree of the variation in international portfolio flows arising from exchange rate movement and exchange rate risk.

[1] Under the managed float, the Bank of Thailand aims to ensure that the value of the baht is allowed to fluctuate under the following conditions; (1) the Bank of Thailand stands ready to intervene in the foreign exchange market such that volatility of the exchange rate is at a level that the economy can tolerate, (2) maintaining national competitiveness, as measured through the Nominal Effective Exchange Rate (NEER), which comprises currencies of important trading partners - and not just the US Dollar, and (3) any intervention does not go against economic fundamentals which would otherwise lead to further imbalances.



Source: CEIC Data

Furthermore, Thai governments have offered special incentives[2] and investment policies in order to promote projects as well as attract direct investment. According to the Board of Investment announcement, the list of activities eligible for promotion consists of agriculture and agricultural products, mining, ceramics and basic metals, light industry, metal products, machinery and transport equipment, electronic industry and electric appliances, chemicals, paper and plastics, and finally services and public utilities industry. Therefore, the impact of exchange rate movements and exchange rate risk on the inflows of FDI in these altogether seven industries eligible for the promotion of the Board of Investment should be somewhat distinguished from the overall FDI as well as FDI in other sectors that are not included in the lists above.

These reasons, consequently, make Thailand an interesting country to examine the impact of exchange rate movements and exchange rate risk on sectoral foreign direct investment and individual firm-specific portfolio investment flows.

[2] The BOI offers two kinds of incentives, regardless of location: tax incentives and non-tax incentives. Tax-based incentives include exemption or reduction of import duties on machinery and raw materials, and corporate income tax exemptions. Non-tax incentives include permission to bring in foreign workers, own land and take or remit foreign currency abroad.

1.2 Statement of Problem/Research Questions

This paper questions whether or not the movements of exchange rate and exchange rate risk play a prominent part in determining the direction of the overall foreign direct investment to Thailand. More importantly, are these relations different across industries? Aside from examining the effect of exchange rate movements and exchange rate risk on foreign direct investment, I also analyze the linkage between the movements of exchange rate, exchange rate risk and portfolio flows at individual firm-specific level to Thailand in order to see whether these effects vary across firms.

1.3 Objective of the Study

There are altogether three distinct objectives of this study.

1.) This paper aims to investigate the effect of exchange rate movements and exchange rate risk on the overall FDI to Thailand. Besides, I also investigate the different responsiveness between the overall FDI inflows and FDI at industry level. This issue is discussed in details in the second objective.

2.) This paper seeks to address a gap in the previous literature by examining the impact of exchange rate movements and exchange rate risk on FDI across sixteen sectors. By the nature of each industry, FDI in manufacturing category should have a stonger reaction to exchange rate movements and exchange rate risk when compared with FDI in nonmanufactuing category. This can be decribed by the fact that manufacturing sectors are mainly associated with importing capital and other inputs as well as exporting outputs whereas the operation of nonmanufactuing sectors are mostly dependent upon domestic markets; as a consequence, exchange rate movements and exchange rate risk tend to have more powerful influence on FDI in manufacturing category with respect to nonmanufacturing category.

Moreover, the sensitivity of FDI in manufacturing category to exchange rate movements and exchange rate risk should closely resemble FDI at the overall level on the ground that the overall flows of FDI and FDI in manufacturing category are naturally highly expose to global uncertainties; therefore, the responsiveness of the overall flows of FDI and FDI in manufacturing category to exchange rate movements and exchange rate risk are likely to be near similar.

These abovementioned explanations raise doubt regarding the different effects of exchange rate movements and exchange rate risk on the overall FDI and FDI at industry-specific level.

3.) This paper attempts to find out the answer concerning the relationship between exchange rate movements, exchange rate risk, and portfolio investment across individual listed firms in the Stock Exchange of Thailand. Because firms' characteristics such as market capitalization, market-to-book value, securities'return, and beta of each individual firm are dissimilar; therefore, I then try to examine the different response of exchange rate movement and exchange rate risk on individual firm-specific foreign portfolio investment.

1.4 Research Hypotheses

The main purpose of this paper is to test the altogether three main hypotheses.

Hypothesis 1: I investigate the impact of exchange rate movements and exchange rate risk on the overall direct investment flows into Thailand with a prediction that depreciation of Thai Baht and low currency risk enhance the overall flows of FDI to Thailand.

For exchange rate movements, there are altogether three main channels of exchange rate transmission to firms' investment, according to Campa and Goldberg (1999) . First of all, a depreciation of local currency increases domestic prices, in respond to a rise in competing imported goods. This increase in price then decreases the revenue as well as wealth, and eventually negatively affects the firms' profitability and investment level. This channel is called the wealth effect channel. For the second channel, a depreciation of domestic currency lowers the domestic currency value of domestic exports in terms of foreign export price, thereby expanding the volume and revenue of exporting activities and finally enhancing the level of investment. The last channel can be explained by imported input channel. A domestic currency depreciation increases domestic costs of imported intermediate inputs and this then consequently reduce the marginal profitability and the level of investment. Nonetheless, the effect of this price changes on investment level is also dependent on the degree of substitutability between these inputs as well as capitals. In this study, the positive effect from depreciation of Thai Baht is expected to dominate the negative effect; therefore, the overall flow of FDI to Thailand is likely to rise after the realization of Thai Baht depreciation.

As for exchange rate risk, the higher degree of exchange rate risk is predicted to lower the overall flows of FDI to Thailand, referring to the study of, Servén (1999) and Foad

(2005). These studies reveal that exchange rate risk impacts FDI through two major channels. The first channel is called exchange rate steadiness suggested that a stability of dollar corresponded with an increase in the level of total investment inflow. Another channel is marginal revenue and cost, the exchange rate risk creates an uncertain climate for foreign investors by making profitability and cost of investment activities harder to predict.

Nonetheless, there may also be the positive link between exchange rate risk and the overall FDI. This relation can be described that FDI is seen as export substituting, so an increases in currency risk raise the use of local production as a substitute for reduced exports and firms engage in FDI in order to avoid the exchange rate risk which is the cost of international trade, according to Markusen (1995).

However, there might be the case that exchange rate risk has no significant impact on the level of FDI. Phillips et al (2008) state that under the production flexibility approach, producers commit to local and foreign capacity ex ante and commit to employment decisions ex post, after the realization of real shocks. Thus, investment decision is not determined by exchange rate risk.

Hypothesis 2: I examine the relation between exchange rate movements, exchange rate risk and international direct investment flows at the sector-level which is anticipated to be sector-specific.

Concerning the exchange rate movements, the paper of Krishnamoorthy (2001), Landon and Smith (2009) explain that it is naturally known that manufacturing sectors are mainly associated with importing capital and other inputs as well as exporting outputs; as a result, the linkage between exchange rate movements and direct investment level in this sector is relatively important. Additionally, in the sector where its operation is determined in world markets, as is typical of manufacturing sector, the impact of exchange rate movements could be either positive or negative. A depreciation of local currency increases imported input price and decreases exported output price, these simultaneous effects could possibly lead to both contraction and expansion of the arrival of FDI. In nonmanufacturing industries, they typically have few exports and imports because these firms naturally operate in pure domestic market. Therefore, the inflows of FDI in nonmanufacturing sector are also less impacted by the movements of exchange rate as it basically experiences a small demand effect following any unanticipated changes.

However, there might be the case that FDI in nonmanufacturing sector is determined by exchange rate movements and exchange rate risk. In this case, it may presumably say that some sectors which are classified as nonmanufacturing may be heavily supported by external source of funds and less driven by internal finance. Thus, exchange rate movements and exchange rate risk consequently determine the inflows of foreign investment in these sectors, even though they are typed as nonmanufacturing category.

As for the exchange rate risk, Landon and Smith (2009) state that an increase in exchange rate risk leads to the unpredictable cost of imported inputs and shares of foreign sales in total sales, resulting in a fall in direct investment in the manufacturing sector. In nonmanufacturing industries, most of them might not be affected by exchange rate risk because their operation is less related to global market. Nonetheless, Markusen (1995) investigates that firms engage in FDI in order to avoid the exchange rate risk which is the cost of international trade. This evidence leads to the conclusion that the long term investment is likely to be longer tied in the country with high degree of exchange rate risk.

As a consequence, this study anticipates that the impact of exchange rate movements and exchange rate risk on FDI at industry-level would turn to be sector-specific according to the aforementioned reasons.

Hypothesis 3: I try to find the impact of exchange rate movements and exchange rate risk on individual firm-specific portfolio investment flows into Thailand. In this case, I expect that these relations are different across firms.

The movements of exchange rate influence the inflows of foreign portfolio investment through changes in relative values of domestic and foreign assets and liabilities, according to Muller and Verschoor (2009). Nucci and Pozzolo (1999) report that the impact of the movements in exchange rate on investment of each individual firms are likely to be distinguished as it critically depends on the firms' exposure with the global market. These literatures drive to the prediction that exchange rate movements would influence foreign portfolio investment in each firm on different degrees. In case that depreciation of Thai Baht increases international investors to move their fund flows to Thailand, it can be explained by the findings from Froot and Stein (1991) claimed that since currency depreciation in host country enhances the wealth of foreigners, thereby allowing them to make higher purchases for more assets and driving up the aggregate portfolio investment demands. On the contrary, if appreciation of Thai Baht enhances international portfolio flows, it may be interpreted with

the reason of momentum investors on the ground that in case that foreign investor allocate their funds to portfolio investment and Thai Baht subsequently appreciates, the profitability earned from international diversification would increase when they convert their profit from Thai Baht currency to their home country currency. Because momentum investors are likely to invest based on historical performance; therefore, they tend to flow their funds to Thailand when Thai Baht appreciates.

With regard to exchange rate risk, this paper forecasts that exchange rate risk would reduce the individual firm-specific foreign portfolio investment simply because exchange rate risk is taken into consideration as another important source of nondiversifiable risk made foreign investment riskier relative to domestic investment; this results in the lower level of foreign portfolio investment, referring to Carrieri and Majerbi (2006).

Nonetheless, the positive impact could possibly be occurred. Eun and Resnick (1988) demonstrate that exchange rate risk is somewhat valuable to multinational investors due to its capability to capture the high potential gains from international diversification.

The remainder of this paper is organized as follows. Chapter2 provides a literature review of this study. The data are presented in Chapter 3 and the research methodology is explained in Chapter 4. The empirical results and conclusions are in Chapter 5 and 6, respectively.

CHAPTER II

LITERATURE REVIEW

Previous literatures related with the relationship between exchange rate and foreign investment is basically classified into two viewpoints. The first viewpoint focuses on the effect of exchange rate movements on foreign investment while another viewpoint concentrates on the relation between exchange rate risk and foreign investment. Although a number of literatures have placed considerable emphasis on these two research topics, the effect of both exchange rate movements and exchange rate risk on investment is still ambiguous. In this section, I start with the empirical evidence regarding with the relation between exchange rate movements, exchange rate risk, and FDI. Then, those previous literatures concerning the impact of exchange rate movements and exchange rate risk on portfolio investment are later reviewed.

2.1 The Effect of Exchange Rate Movements and Exchange Rate Risk on Foreign Direct Investment

The empirical studies on the impact of exchange rate movement as well as exchange rate risk on FDI are increasingly interesting. According to prior literatures, exchange rate movements and exchange rate risk generates positive, negative, and ambiguous impacts on FDI. I begin by reviewing the literatures regarding the link between exchange rate movements and FDI first, and subsequently follow by the relation between exchange rate risk and FDI.

There are several explanations from previous literature that describes the effect of exchange rate movements on FDI. Gorg and Wakelin (2001) reach a similar result for both direct investment from US to 12 countries and investment from these 12 countries into the US. His empirical work discovers that the exchange rate movements play a role in explaining investment. They reported that the linkage between appreciation in the home country currency and US investment outflow is likely to be positive. In contrast, there is a negative relation between US investment inflow and appreciation in US Dollar.

Osinubi and Amaghionyeodiwe's (2009) study using secondary time series data from1970 to 2004 reveals that there is a significant positive relationship between real inward FDI and exchange rate in Nigeria. They reveal that depreciation of the Naira significantly increases the real inward FDI.

Lisa (1992) investigates that firms that highly expose to exchange rate movements tend to be negatively impacted by the higher degree of exchange rate risk. Besides, it also claims that the uncertainty of exchange rate depresses exporting activity; therefore, countries with high degree of openness should specially pay attention to maintain countries' stability.

In the empirical work of Morsink and Molle (1992), it is stated that investors generally desire for secure investment opportunities and attempt to keep away from exchange rate uncertainties.

Agenor (2001) said that the relation between exchange rate movements and the investment level can possibly appear to be either positive or negative. For the negative side, it can be found in the situation that currency depreciation enhances domestic price which subsequently decreases income and wealth of private sector and this eventually causes producers to lower their investment expenditures. Furthermore, a depreciation of local currency also enhances the costs of imported capital goods, thereby inducing producers to postpone their investment decision. Turning to the positive side, local currency depreciation drives up the price of traded goods compared with the price of home goods; as a result, investment in tradable industry tends to be expanded.

From the study of Jongwanich and Kohpaiboon (2008), they investigate that a depreciation of real exchange rate raises the level of private investment in Thailand in the long term. In this case study, the positive effect of the depreciation on tradable industry dominates the negative effect that may appear in the nontradable industry. This reflects the nature of export-led growth economy in Thailand in the sense that depreciation generates benefit to export sector and expands investment level. They additionally reveal that even though exchange rate movement has some implications on investment level, its effect is less important than other determinants such as output growth, lagged investment, as well as credit accessibility. For this case, output growth changes significantly have long run effect on investment level.

Campa and Goldberg (1999) suggested that there are altogether three main channels of exchange rate transmission to firms' investment. First of all, a depreciation of local currency increases domestic prices, in respond to a rise in competing imported goods. This increase in price then decreases the revenue as well as wealth, and eventually negatively affects the firms' profitability and investment level. This channel is called the wealth effect channel. For the second channel, a depreciation of domestic currency lowers the domestic currency value of domestic exports in terms of foreign export price, thereby expanding the volume and

revenue of exporting activities and finally enhancing the level of investment. The last channel can be explained by imported input channel. A domestic currency depreciation increases domestic costs of imported intermediate inputs and this then consequently reduce the marginal profitability and the level of investment. However, the effect of this price changes on investment level is also dependent on the degree of substitutability between these inputs as well as capitals.

Turning to the exchange rate risk, there are also numerous viewpoints that have been trying to explain the relationship between exchange rate risk and FDI. I start with the positive view. For the positive viewpoint, FDI is seen as export substituting. Increases in currency risk raise the use of local production as a substitute for reduced exports. Markusen (1995) investigates the supportive evidence; he claims that firms engage in FDI in order to avoid the exchange rate risk which is the cost of international trade.

Cushman (1988) extends the past literatures that have emphasized only inflow or outflow of FDI, he considers both. His study finds a significantly positive relationship between exchange rate volatility and both sets of US FDI flows during the period of 1963-1986.

On the contrary, numerous empirical studies find a negative impact of exchange rate movements and exchange rate risk on FDI. George Zis (1989) summarizes that exchange rate variability significantly decreases direct investment simply because it raises business uncertainty; resulting in a decrease in producers' willingness to enlarge their long term investment. Further, investors tend to move their funds from traded-goods sectors to nontrade-goods industries in case of a rise in volatility of exchange rate since traded-goods products are basically have higher capital-labor ratios compared with nontrade-goods production like services.

George S. Tavlas (1991) reported that exchange rate variation is the additional cost of doing business on the condition that firms are typed as risk-averse and this risk is positively related to the volatility. Moreover, firms also take in to account this risk when planning their transactions in several currencies.

Dixit and Pindyck (1994) demonstrate that as long as investment decision is irreversible, FDI in a country with a high level of exchange rate risk generates an unpredictably expected return on investment.

The study of Baum, Caglayan, and Barkoulas (2001) separates volatility of exchange rate into two views comprised permanent and temporary views. The empirical result demonstrates that higher degree of permanent volatility increases profit volatility; therefore, it leads to the conclusion that less risk-averse investors are likely to move their money into country with higher degree of permanent volatility. However, the opposite result is shown under the temporary volatility.

Foad (2005) applies the Dixit and Pindyck study of investment under uncertainty in his own literature and summarizes that FDI flows from the countries with high degree of currency risk into the countries with higher certainty in currency under the condition of limited potential direct investments.

Benassy Quéré, Fontagné & Lahrèche-Révil (2001) provide the evidence of a negative impact of exchange rate variability on the inflows of FDI to 42 developing countries over the period 1984-1996. Consequently, higher volatility of exchange rate reduces the inflows of FDI in those developing counties.

By using GARCH model of volatility, Serven (2003) investigates that exchange rate volatility negatively affects investment in developing countries. Additionally, his study reveals that the financial systems and the degree of trade openness of country are important in determining the investment effect of exchange rate volatility. Higher degree of openness raises uncertainty in investment, while stronger financial system is positively related with investment.

In the paper of Yip and Yao (2004), it is stated that exchange rate risk that decreases foreign investment inflows could be removed by using financial instruments such as options and futures. However, the development of hedging instrument for international investors, particularly in those developing countries is still inadequate. Therefore, currency risk then deters the inflows of FDI, resulting in a slower growth of these economies.

From several empirical tests, it can be seen that the impacts of both exchange rate level and its volatility on FDI are ambiguous. The study of Bailey and Tavlas (1991) using the data during the period of 1976-1986 reports that exchange rate uncertainty has no significant effect on investment inflows into the US.

Goldberg and Kolstad (1995) study the linkage of real exchange rate variability and international investment participation and their result reveal that manufacturers engage in

international investment diversification in order to achieve ex post production flexibility and higher profitability in response to real shocks. This result is based on the presumption that production flexibility is possible within the window of time before the realization of real shocks. They further explore that if investors are classified as risk neutral, there is no significant relationship between exchange rate volatility and the allocation of production facilities between local and foreign markets. Nonetheless, in case of risk-averse manufacturers, exchange rate volatility is likely to increase the share of investment resources located offshore.

Darby et al (1999) investigates that it is impossible to predict that a decrease in exchange rate volatility results in a rise in investment. This depends upon the marginal profitability, marginal cost, as well as the value of investment.

These brief literature reviews indicate that a consensus about the effect of exchange rate movement and exchange rate risk on FDI among either the theoretical or empirical works is mixed, even though a number of literatures have placed considerable emphasis on this research topic.

2.2 The Effect of Exchange Rate Movements and Exchange Rate Risk on Portfolio Investment

Since international diversification is receiving a growing attention from foreign investors around the world, it is of interest to investigate the relation between exchange rate movements, exchange rate risk, and portfolio investment flows. Unfortunately, the related research on the impact of exchange rate movement and exchange rate risk on international equity investment is somewhat limited. This paper then seeks to examine the effect of exchange rate movements and exchange rate risk on foreign portfolio investment inflows.

In the empirical study of Biger (1979), it is demonstrated that for international point of view, the overall rate of return from holding foreign financial assets consists of investment return (dividends and capital gains) on the assets plus gains and losses from the movements in exchange rate during the holding period. The fluctuation of exchange rate is additional source of uncertainty that may generate both potential gains and losses to investors across countries. Besides, his work reveals that the movements in exchange rate drastically increase foreign investment risk in holding bonds and stocks; nevertheless, the impact of exchange

rate movements on international investment risk for bonds is significantly greater than for stocks due mainly to the reason that stocks are more volatile when compared with bonds.

Eun and Resnick (1988) examine the impact of exchange rate fluctuation on the risk of foreign stock market investment and reveal that under the Modern Portfolio Theory (MPT), investors estimate the risk-return characteristics of financial assets when constructing optimal portfolios. In this case, exchange rate variation contributes to the portfolio risk. On the contrary, according to efficient international portfolio strategy, the fluctuation of exchange rate is rather valuable to multinational investors due to its capability to capture the potential gains from international diversification. Furthermore, they also investigate that the variability of exchange rate is found to account for approximately fifty percent of the variability of dollar returns from equity investment in such major countries as Japan, Germany, and the U.K.

Prasad and Rajan (1995) examine the effect of currency and interest rate risk on equity valuation in five countries and find that exchange rate fluctuation is priced in most markets while interest rate risk is not priced in any countries.

Solnik (1996) studies the link between exchange rate variation and risk as well as return on foreign investment covering the period 1971 to 1994 and concludes that the contribution of exchange rate variation to the aggregate investment risk is rather small whether investment in a single stock market index or investment in an internationally diversified portfolio of stock market indices. In case of the contribution of currency variation to return on investment, his results further show that exchange rate variation is the major source of investment return in short time. For long periods of time, capital gains or investment income is the determinant of return on a diversified portfolio simply because an appreciation of one currency is generally offset by a depreciation of another.

The paper of Nucci and Pozzolo (1999) finds out that an increase in exchange rate variation brings about additional source of uncertainty and risk for multinational companies through profitability as well as international trade channel. The risk exposure of international firms' operation might be due to adjustment in revenue, cost of inputs, and competitive positions of firms. This, consequently, implies that exchange rate volatility is one of the most important sources of companies' risk.

Servén (1999) finds out that the volatility of exchange rate creates an uncertain climate for foreign investors by making profitability and cost of investment activities harder to predict. Furthermore, it is also summarized that the impact of exchange rate volatility on investment depends on the degree of economy openness and financial system. Higher

openness and weaker financial development negatively relates with uncertainty in investment, while stronger financial system and low openness holds the opposite direction.

Apart from that, Muller and Verschoor (2009) recently discovers that exchange rate environment plays an increasingly prominent role in changes in relative values of domestic and foreign assets and liabilities, this then results in changes in the level of international portfolio investment flows.

Gourinchas and Rey (2005) indicate that the variation of exchange rate affects the U.S. economy both through trade channel as well as gains and losses on U.S. financial assets valuation.

Corsetti and Konstantinou (2005) document that the valuation effect of exchange rate sensitivity performs as wealth transfer across countries, with the capital gains to U.S. investor following depreciation in dollar offset by capital losses for foreign investors. This indicates that the welfare effect of redistribution of wealth is obviously considerable.

Carrieri and Majerbi (2006) reports that in foreign investors' view, currency risk are taken into account as another source of nondiversifiable risk made foreign investment riskier relative to domestic investment. As a result, extra premium in forms of expected return is required in order to compensate for exchange rate risk when investing in international markets.

As reviewed earlier, it can be clearly seen that most empirical studies examining the relationship between real exchange rate movements, exchange rate risk, and international portfolio flow have focus on the industrial countries such as the USA, German, Japan, and the UK. Only limited investigation is available regarding the effect of real exchange rate movements and exchange rate risk on portfolio investment in developing countries. This paper work then investigate the relationship between exchange rate movement, exchange rate risk and foreign portfolio investment as well as extend those previous literatures by analyzing the firm-specific foreign portfolio investment in Thailand responsiveness to exchange rate movements and exchange rate risk.

CHAPTER III

DATA

This part contains data explanation, data sources as well as the descriptive statistics. I begin with the data in foreign direct investment section first, and portfolio investment section is then subsequently followed. Also, the stationary test and the construction of exchange rate volatility are discussed.

3.1 Data for Foreign Direct Investment Section

The period in this section estimates from January 2001 to December 2009. All data used in this part are monthly time-series data. The data explanation, their sources, as well as data description are described below.

- *The Overall Foreign Direct Investment and Foreign Direct Investment by sector*

The overall FDI and FDI at sector level on monthly basis can be collected from the Bank of Thailand. In order to analyze the effect of exchange rate movements, and exchange rate risk on FDI at sector-level, this paper, along with prior study, groups FDI in Thailand by sector as follows:

Table1: Foreign Direct Investment in Thailand at industry-level

Investment Categories	Industries
All Industries	
Manufacturing	
- Durables Goods	- Construction Materials
	- Machinery and Transportation Equipment
	- Electrical Appliances
	- Metal and Nonmetallic
- Nondurables Goods	- Food and Sugar
	- Textiles
	- Chemicals
	- Petroleum Products
Nonmanufacturing	- Financial Institutions
	- Trade
	- Agriculture
	- Construction
	- Mining and Quarrying
	- Investment
	- Services
	- Real Estate

As shown in the table above, FDI in Thailand industry are grouped into 5 different categories of investment including with all industries, manufacturing, manufacturing durables, manufacturing nondurables, and nonmanufacturing. Overall, 16 industries are identified.

- *Real Manufacturing Production Index*

I collect the Real Manufacturing Production Index (Real MPI) from the Bank of Thailand. The data is provided on the monthly basis. The Real MPI is used simply because it can directly reflect the production of each industry. Furthermore, it corresponds with the dependent variable, FDI, which is analyzed by industry-level.

- *The Cost of Capital*

This paper uses 3-month Treasury bill rate as the representative for the cost of capital and the monthly rate of 3-month Treasury bill is found from the Thai Bond Market Association. Prapassornmanu (2009) has introduced the interest rate as additional control variable for investment decision under the reason that a decline in interest rate decreases the cost of capital which then generates higher profit from owning capital. This consequently drives up the foreign investment level.

In Table 2, I report statistical summary of data including with mean, standard deviation, maximum, and minimum values of all monthly data in FDI section. From Table 2, it is apparently seen that there are both negative and positive signs for descriptive statistics of the overall FDI and sectoral FDI. The negative sign reflects the outflows of FDI while the positive sign refers to the inflows of FDI. The overall flows of FDI lie between -0.013 and 0.0750. As for FDI in each category, the summary statistics also appear to be positive as well as negative. The average FDI in manufacturing durables goods is 0.0069 while FDI in manufacturing nondurables category is around 0.0018. In nonmanufacturing category, FDI is approximately 0.0079. In manufacturing category, the maximum mean of FDI inflows is 0.0036 for machinery and transportation equipment sector; whereas the minimum mean of FDI is 0.0001 for construction materials sector. In nonmanufacturing category, the maximum mean of FDI inflows is 0.0020 for financial institution sector, while the minimum mean of FDI is 0.00002 for agriculture sector. The average interest rate is approximately 2.4624 while the Real MPI is around 144.5244. For the direction of real exchange rate, the value of Thai

Baht with respect to other currencies in the basket depreciates 0.0001. The Japanese Yen and US currency depreciates 0.00001 and 0.0002 respectively during the period 2001 to 2009.

Table2: Basic descriptive statistics of FDI section

Variables	Mean	SD	Maximum	Minimum
Time period 2001-2009 (T=9)				
FDI in All Industries (Billion Baht)	0.0207	0.0124	0.0750	-0.0130
FDI in Manufacturing	0.0113	0.0048	0.0327	-0.0009
Durables Goods	0.0069	0.0034	0.0210	-0.0017
Construction Materials	0.0001	0.0002	0.0006	-0.0019
Machinery and Transportation Equipment	0.0036	0.0027	0.0163	-0.0076
Electrical Appliances	0.0023	0.0022	0.0129	-0.0024
Metal and Nonmetallic	0.0009	0.0012	0.0068	-0.0038
Nondurables Goods	0.0018	0.0022	0.0061	-0.0059
Food and Sugar	0.0005	0.0013	0.0061	-0.0059
Textiles	0.0002	0.0002	0.0009	-0.0005
Chemicals	0.0009	0.0015	0.0049	-0.0116
Petroleum Products	0.0002	0.0016	0.0045	-0.0075
FDI in Nonmanufacturing	0.0079	0.0113	0.0620	-0.0266
Financial Institutions	0.0020	0.0047	0.0215	-0.0161
Trade	0.0018	0.0068	0.0311	-0.0352
Agriculture	0.00002	0.0001	0.0006	-0.0005
Construction	0.00004	0.0004	0.0010	-0.0037
Mining and Quarrying	0.0010	0.0019	0.0068	-0.0035
Investment	0.0007	0.0059	0.0444	-0.0221
Services	0.0014	0.0030	0.0182	-0.0068
Real Estate	0.0010	0.0020	0.0061	-0.0051
Real Interest Rate	2.4624	1.1750	4.9371	1.0200
Real MPI	144.5244	27.3555	195.8930	98.3088
The Real Barclays Capital EERs	0.0001	0.0006	0.0020	-0.0016
The Japanese Yen against Thai Baht	0.00001	0.0012	0.0030	-0.0047
The US Dollar against Thai Baht	0.0002	0.0007	0.0024	-0.0020

3.2 Data for Portfolio Investment Section

In this part, panel data techniques are introduced in the sense that the particular characteristics of each individual firm that influences foreign investors' decision are captured by fixed effect. All data used in this section are estimated on monthly basis. The estimation interval spans from January 2005 to December 2009. The data explanation, their sources, as well as descriptive statistics are reported below.

- *Portfolio Investment at Firm-specific Level*

This study uses foreign trading as the representative of portfolio investment at firm-specific level. The data on company-specific foreign trading classified into purchase and sale in terms of baht value can be collected on a monthly basis from the Stock Exchange of Thailand. In this study, foreign trading is calculated from foreign purchase deducts foreign sales. Nonetheless, this study does not take into account all listed companies in the Stock Exchange of Thailand because some stocks are thinly traded by foreign investors, so they are not a good proxy to study the effect of exchange rate movements and exchange rate risk on foreign trading and they might also make the estimated results biased. To protect this problem, this study then particularly selects the firms in the Stock Exchange of Thailand with 80% highest cumulative value of foreign trading during the year 2005-2009. By doing so, 335 firms are included in the sample set.

- *Size*

The factor *size* is the natural logarithm of the firm's market capitalization. I gather firm's market capitalization from the Datastream. According to the paper of Eva and Anders (2005), it is stated that the variable size can capture the impact of asymmetric information. Less information provided in small firms with low market capitalization brings about information asymmetries rising among different types of investor. It additionally reveals that transaction costs like spreads are proportionally higher for small firms. Consequently, foreign investor could possibly be expected to prefer firms with high market capitalization.

- *Market-to-Book Ratio*

Market-to-book ratio is measured as the market value of equity divided by the book value of equity. It can be collected from the Datastream. Referring to the study of Fama and French (1992, 1993), they indicate that, apart from BETA, asset returns are also dependent upon size and market-to-book ratio. Their paper explains that larger firms with a high market-to-book ratio tend to generate lower returns when comparing with smaller firms with a low market-to-book ratio. In consistent with their findings, Miyajima and Yafeh (2007) find that size of firm as well as market-to-book ratio are among the most influential factor of firm performance. Thus, market-to-book ratio should also be included as explanatory variable in the regression.

- *Stock Return*

Stock return is represented in the form of log return of stock price. The variable stock price is gathered from the Datastream. In the research paper of Eva and Anders (2005), they claim that the variable stock return should be included in order to examine whether international investors are classified as momentum or contrarian. Further, this explanatory variable reflects that whether or not the rate of return from holding the financial securities causes the differentiating investment decision of international investors.

- *Beta*

BETA is the standardized measure of systematic risk. The major variables used to compute for the Beta of each stock are individual stock return and market portfolio return. I collect these two variables from the Datastream. According to capital asset pricing model (CAPM), risk of assets comprises firm-specific idiosyncratic risk which can be eliminated by diversification, and systematic risk measured by BETA that cannot be diversified. In other words, BETA is a contribution of stock to the riskiness of a well-diversified portfolio. This variable then measures the volatility of the stock returns relative to the returns on the market portfolio. In this study, the variable BETA is calculated with historical monthly return data for the five-year period. The following model is regressed in order to estimateβ_i.

$$\left(R_{i,t} - R_{f,t}\right) = \alpha_i + \beta_i\left(R_{M,t} - R_{f,t}\right) + \varepsilon_i \qquad (1)$$

where α_i refers to the estimated intercept of the regression, β_i is CAPM Beta, $R_{i,t}$ represents individual stock return, $R_{f,t}$ is risk-free rate, $R_{M,t}$ is market portfolio return, and ε_i is the error term.

- *Real Effective Exchange Rate: The Real Barclays Capital Effective Exchange Rate*

This study uses the real effective exchange rate in log return form as a representative of exchange rate movements since this study realizes that real effective exchange rate is the appropriate measure provided the ability to capture the importance of countries' competitiveness. Kiyota and Urata (2004) reveal that real effective exchange rate method has been weighted by the level of trade and investment between each country and the rest of the world. Thus, the real effective exchange rate is used in many studies related to this filed because it is more practical compared to bilateral exchange rate.

Since the real effective exchange rate is further employed to construct the volatility of exchange rate by using the GARCH(1,1) model; as a consequence, highly frequent series are required. Therefore, this paper then employs the real Barclays Capital Effective Exchange Rates which is available on daily basis as a proxy for the real effective exchange rate. The description of the real Barclays Capital EERs is described as follows:

According to foreign exchange research of Barclays Capital (2011), the Barclays Capital EERs is the method that uses weights calculated using all goods and services, taking the third-county competition into account. As a result, the Barclays Capital EERs differs from the simple trade-weighted indices for countries that conduct a lot of trade in third countries in which other countries also trade heavily.

The construction of the index weights are based on the measure of trade competitiveness. In a simple trade-weighted index, the weight assigned to country *j* in country *i*'s index is given as follows:

$$w_{i,j} = \frac{x_{i,j} + m_{i,j}}{x_i + m_i}, i \neq j \quad (2)$$

where $x_{i,j}$ denotes the value of exports of country *i* to country *j*, $m_{i,j}$ represents the value of imports of country *i* from country *j*, x_i is the total value of exports of country *i*, m_i is the total value of imports of country *i*. Note, $x_{i,j} = m_{j,i}$ and $\sum_{j,i \neq j} w_{i,j} = 1$.

Nevertheless, the simple trade-weighted index neglects the importance of third-country competition. Consequently, the Barclays Capital EERs follow the equation (2) in giving the weight as:

Import weight

$$w_{i,j}^{m} = \frac{m_{i,j}}{m_i} \quad (3)$$

Export weight

$$w_{i,j}^{x} = \left(\frac{x_{i,j}}{x_i}\right)\left[\frac{y_j}{y_j + \sum_{h \neq \{i,j\}} x_{h,j}}\right] + \sum_{k \neq \{j,i\}} \left(\frac{x_{i,k}}{x_i}\right)\left(\frac{x_{j,k}}{y_k + \sum_{h \neq \{k,j\}} x_{h,k}}\right) \quad (4)$$

Total weight

$$w_{i,j} = \left(\frac{m_i}{m_i + x_i}\right) w_{i,j}^{m} + \left(\frac{x_i}{m_i + x_i}\right) w_{i,j}^{x} \quad (5)$$

where y_j is value of country j's consumption which is domestically produced, that is calculated as $y_j = GDP_j - x_j$

Given the weight, the real Barclays Capital EERs (Q_t) is computed as follows:

$$Q_t = Q_{t-1} \prod_{j,j \neq i} \left(q_{i,j}^t / q_{i,j}^{t-1}\right)^{w_{i,j}^t} \quad (6)$$

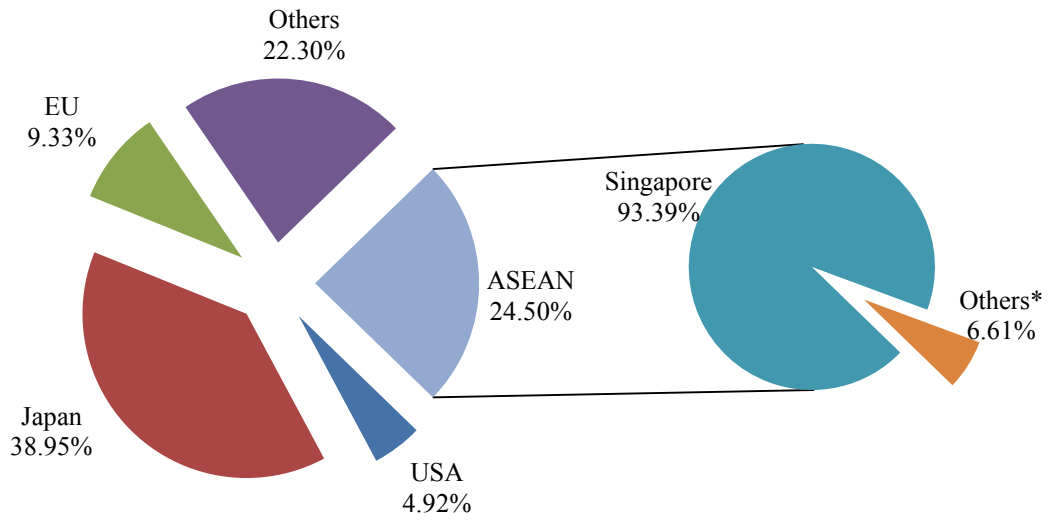
where $q_{i,j}$ is the bilateral real exchange rate

- *Bilateral Exchange Rates*

To further explore the effect of exchange rate movements and exchange rate risk on the inflows of both foreign direct investment and portfolio flows, bilateral exchange rates consisted of the Japanese Yen as well as the US Dollar are introduced. The supportive reasons for employing these two currencies are explained hereunder.

- *The Japanese Yen*

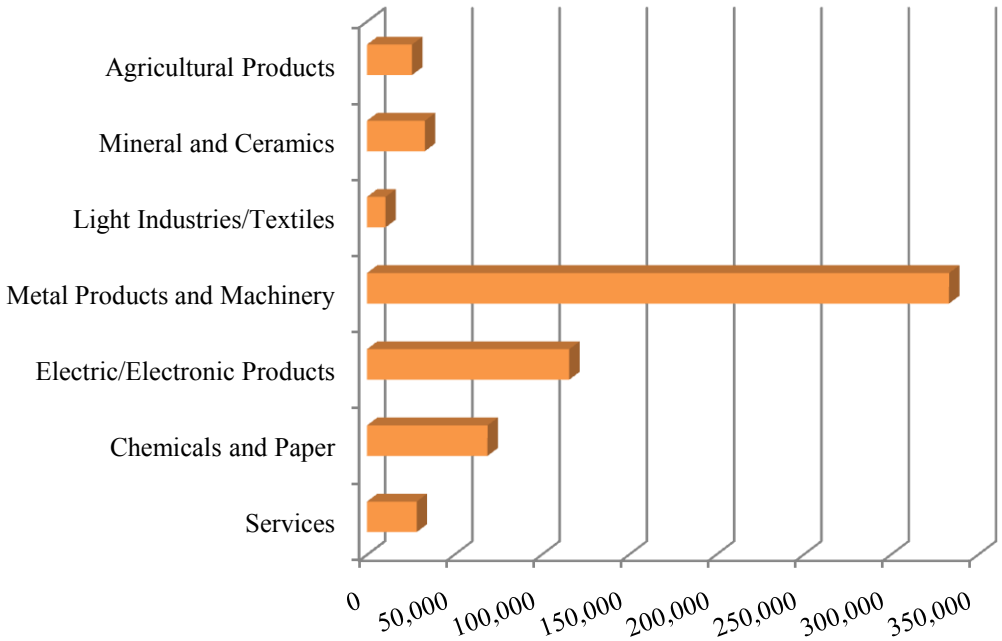
Figure2: Cumulative FDI Classified by Country during 2001-2009



*Others refer to Hong Kong, Taiwan, South Korea, China, Canada, Australia, and Switzerland

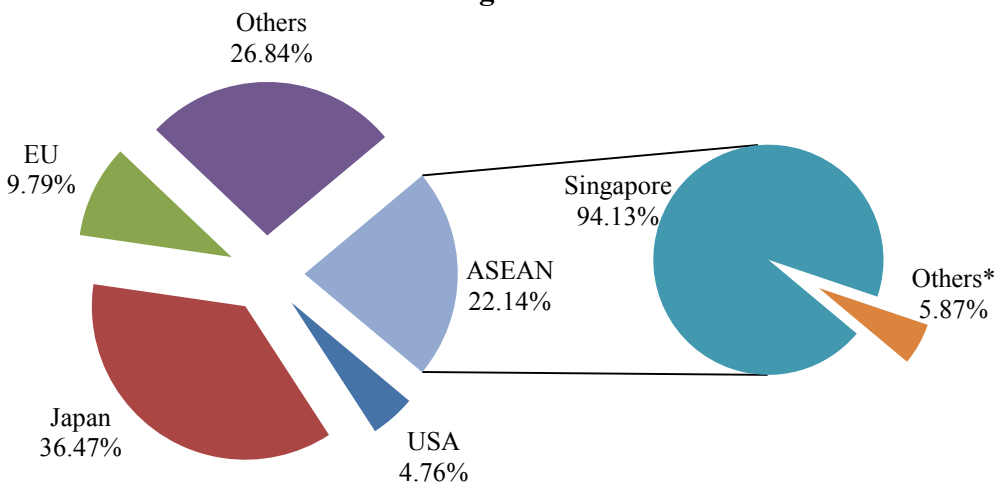
Source: Bank of Thailand

Figure3: Cumulative Japanese Investment Projects Approved by BOI Classified by Sector during 2005-2009 (Million Baht)



Source: The Board of Investment

Figure4: Cumulative Net Flow of Foreign Equity during 2005-2009



*Others refer to Hong Kong, Taiwan, South Korea, China, Canada, Australia, and Switzerland

Source: Bank of Thailand

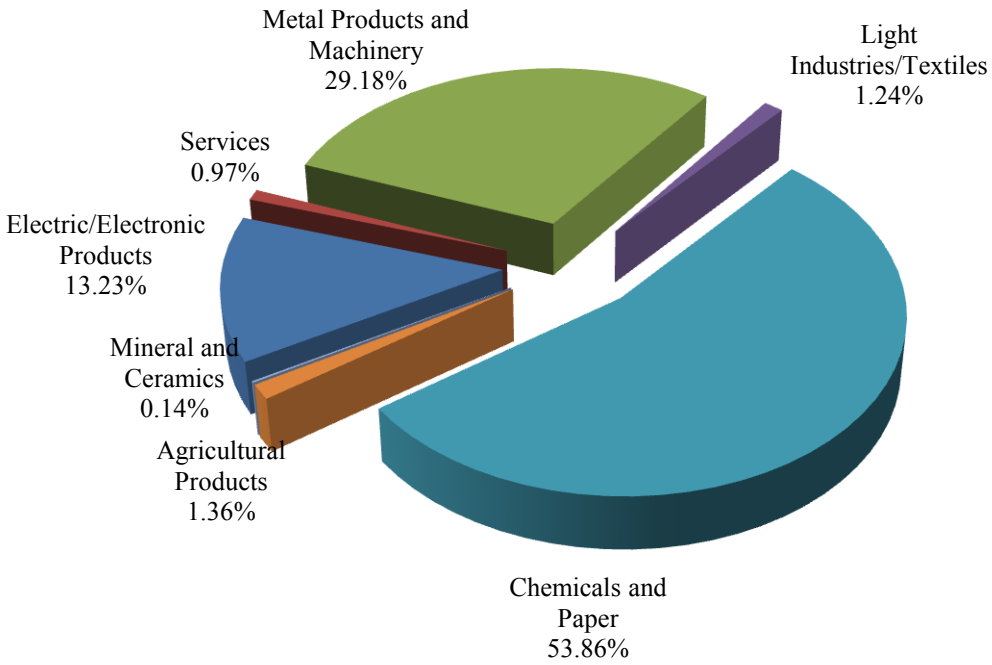
According to the two graphs in Figure 2 and 3, it demonstrates that Japanese investment project constitutes the largest proportion of the inflows of FDI to Thailand, particularly in manufacturing durables industries, metal products and machinery, as well as electric and electronic products. Furthermore, the pie chart presented in Figure 4 induces to conclude that Japan ranks among the largest source of foreign equity flows to Thailand followed by Singapore, European Unions, and USA, respectively. As a consequence, the Japanese Yen movements and its volatility should be powerful in determining the destination of FDI and international portfolio flows to Thailand. Taking into account the importance of this currency, this paper then additionally stress the idea that how the movements of Japanese Yen and its volatility influence FDI and portfolio inflows to Thailand.

- *The US Dollar*

Even though the inflows of FDI and international portfolio flows to Thailand are not principally governed by US investment project, referring to the pie chart in Figure 2 and 4. This study also specially focuses on the impact of US Dollar movements and its volatility simply because in terms of financial transaction, the US Dollar is the key currency instead of the real effective exchange rate index when making a purchase and sale across countries.

Moreover, the pie chart in Figure 5 reports the cumulative US investment projects covering the year 2005 to 2009, the statistics show that US investors primarily invest in manufacturing durables products consisting of chemicals and paper, metal products and machinery, as well as electric and electronic products industries. Therefore, FDI inflows, especially in manufacturing durables industry may possibly heavily rely on depreciation/appreciation of US Dollar as well as its volatility.

Figure5: Cumulative US Investment Projects Approved by BOI Classified by Sector during 2005-2009



Source: The Board of Investment

Table 3 presents some descriptive statistics comprised the mean, standard deviation, maximum and minimum values of all variables used in portfolio investment section. Consider Table 3, the average net foreign trading is 0.0065. Size is ranged between 0.3784 and 13.9736 whereas Market to Book value lies between -469.9700 and 171.7700 during the year 2005-2009. The variable Stock Return is approximately 0.0085 while the CAPM Beta of stock is around -0.0003.

Table3: Basic descriptive statistics of portfolio section

Variables	Mean	SD	Maximum	Minimum
Time period 2005-2009 (T=5)				
Net Foreign Trading (Billion Baht)	0.0065	0.4123	10.7045	-11.7336
Size	7.9433	1.6124	13.9736	0.3784
MVBV	1.3058	8.3561	171.7700	-469.9700
Stock Return	0.0085	0.2474	20.4545	-0.9899
CAPM Beta of Stock	-0.0003	0.0001	0.0013	-0.0005

- *The Volatility of Real Exchange Rate*

In order to construct the volatility of real exchange rate, I employ autoregressive conditional heteroskedastic (ARCH), and generalized autoregressive conditional heteroskedastic GARCH(1,1) for modeling heteroskedastic conditional volatility[3]. According to ARCH (Engle, 1982), it supposes that the variance of the error term in a given period is dependent on the squared error terms from prior periods. The volatility in previous periods can be captured by the lags of the squared residuals. As for GARCH (Bollerslev, 1986), it expands the ARCH model to allow for the variance of the error term to be dependent on its own lags and also lags of the squared errors. Hence, the GARCH model captures the volatility change with less parameter than the ARCH model. In this study, the GARCH (1,1) model is employed to construct the volatility of exchange rate simply because the GARCH (1,1) model successfully captures autocorrelation problems.

To construct the exchange rate volatility, I begin by explaining the AR process from Box-Jenkins Methodology in order to specify the optimal AR lags. The AR model is written as follows:

$$REER_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i REER_{t-i} + \varepsilon_{i,t} \quad (7)$$

According to Bollerslev (1987), it explains that Akaike Information Criteria (AIC) is one of the most important model selection criteria that trade off a reduction in the sum of squares of the residuals for a more parsimonious model. Consequently, in order to specify the possible AR lags, the AIC method is used in this paper.

$$AIC = T\ ln\ (\sum \varepsilon_t^2) + 2n \quad (8)$$

where n is number of parameters estimated (p + q + possible constant term). The AIC measures squared deviations of the model of the mean. Therefore, the lowest AIC show evidence of a good fit model.

[3] The volatility of exchange rate is also constructed by using another alternative method defined as the monthly average standard deviation of daily real Barclays Captital Effective Exchange Rates. However, this method provides similar results as GARCH (1,1) when used in the estimated equations.

Table4: Optimal lag selected by AIC

AR	(1)	(2)	(3)	(4)	(5)
The Real Barclays Capital EERs	-8.8339	-8.8347	-8.8344	-8.8348	-8.8361
The Japanese Yen	-7.3851	-7.3914	-7.3888	-7.3927	-7.3907
The US Dollar	-8.8918	-8.8927	-8.8921	-8.8925	-8.8975

From Table4, the AR (1) specification for all variables including with REER, JPY, and USD are selected on the criteria of AIC. Therefore, the GARCH(1,1) model is expressed as follows:

$$\Delta REER_t = \alpha_0 + \alpha_1 \Delta REER_{t-1} + \varepsilon_t ; \quad \varepsilon_t/\psi_{t-1} \sim N(0, h_t), \psi_{t-1} \qquad (9)$$

$$h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \omega_1 h_{t-1} \qquad (10)$$

where $\Delta REER_t$ is log return of real exchange rate, ε_t is the error term , h_t is the current conditional volatility, and h_{t-1} is the lagged conditional volatility. The variable $\Delta REER_t$ and $\Delta REER_{t-1}$ in equation (9) are substituted by ΔJPY_t and ΔJPY_{t-1} when constructing the Japanese Yen volatility. In case of the volatility of the US Dollar, ΔUSD_t and ΔUSD_{t-1} are plugged in equation (9) instead of $\Delta REER_t$ and $\Delta REER_{t-1}$.

Nevertheless, GARCH(1,1) model is strictly required that all of the estimated coefficients have to be positive. In addition, the summation of ARCH terms (p) and GARCH terms (q) are closed to one. These indicate that the model is quite constrained; thereby raising the difficulties in estimating estimation. Table 5 demonstrates the ARCH terms (p) and GARCH terms (q) for the variable real Barclays Capital EER (Logarithm), JPY (Logarithm), and USD (Logarithm). Apparently, for real Barclays Capital EER (Logarithm), there is significance in ARCH parameter which is equal to 0.2177 and GARCH parameters that equals 0.7345. As for the JPY (Logarithm), ARCH parameter is approximately 0.0693, while GARCH parameter is around 0.9131. In case of USD (Logarithm), the ARCH and GARCH parameters are 0.1312 and 0.8609, respectively.

Evidently, both ARCH and GARCH parameters of these altogether three variables are significantly positive which are satisfied the specification requirement of non-negativity for all of the models. In addition, the summation of the ARCH terms (p) and GARCH terms (q) of each variable are significantly closed to one. As a consequence, these variables can be used to construct the volatility of exchange rate. Figure 6-8 demonstrate the volatilities of real exchange rate constructed by GARCH (1, 1) model. The monthly volatility is constructed by using monthly average log return of daily real Barclays Capital EER.

Table5: ARCH(p) term and GARCH(q) term from GARCH(1,1)

	Barclays REER (Logarithm)		The Japanese Yen (Logarithm)		The US Dollar (Logarithm)	
	Coefficient	z-Statistics	Coefficient	z-Statistics	Coefficient	z-Statistics
ARCH(p)	0.2177	27.2640***	0.0693	10.6723***	0.1312	21.4012***
GARCH(q)	0.7345	65.9265***	0.9131	117.5581***	0.8609	215.6987***

This table reports the estimation for the GARCH(1,1) model given by:

$$\Delta REER_t = \alpha_0 + \alpha_1 \Delta REER_{t-1} + \varepsilon_t \; ; \quad \varepsilon_t / \psi_{t-1} \sim N(0, h_t), \psi_{t-1}$$
$$h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \omega_1 h_{t-1}$$

z-statistics are reported in parenthesis and "***" denotes coefficient is significant at the 1% level

Figure6: Volatility of Real Barclays Capital EERs (Logarithm)

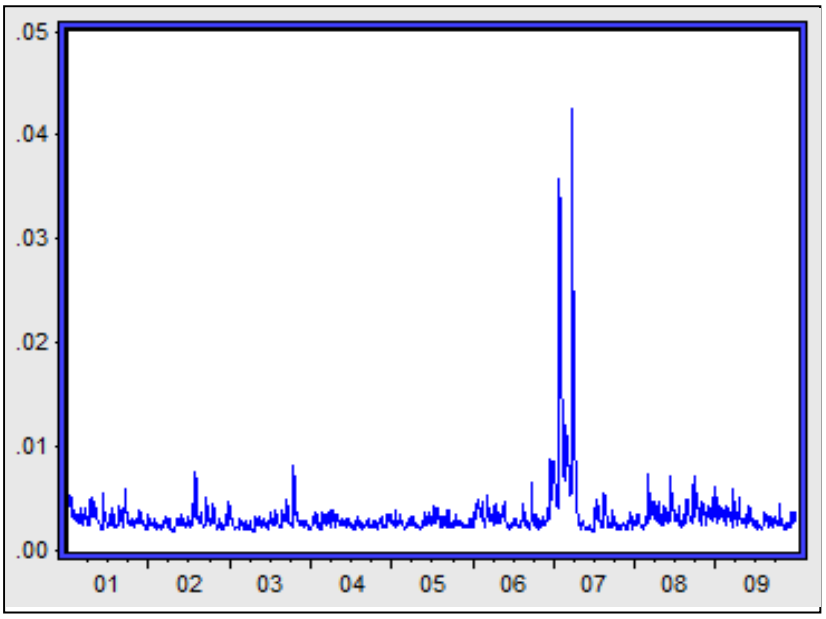


Figure7: Volatility of Japanese Yen (Logarithm)

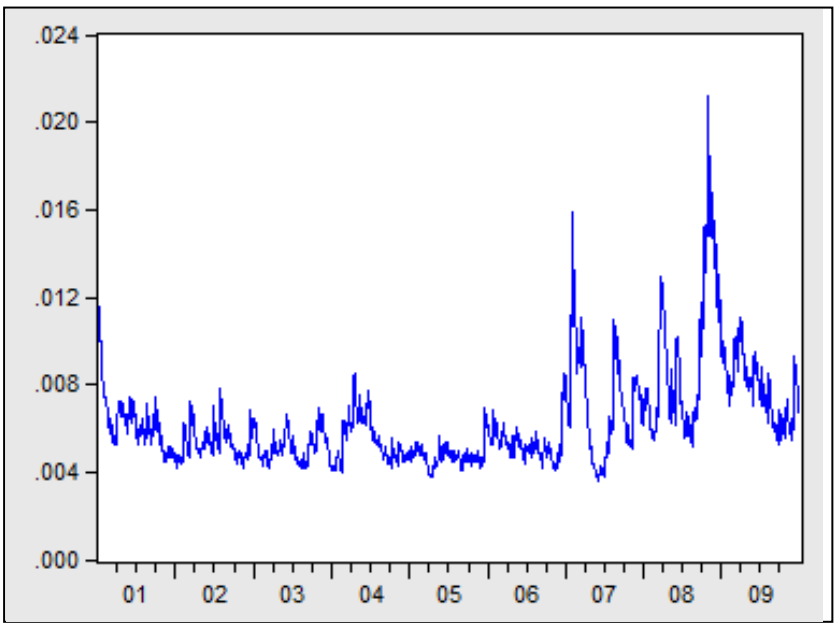
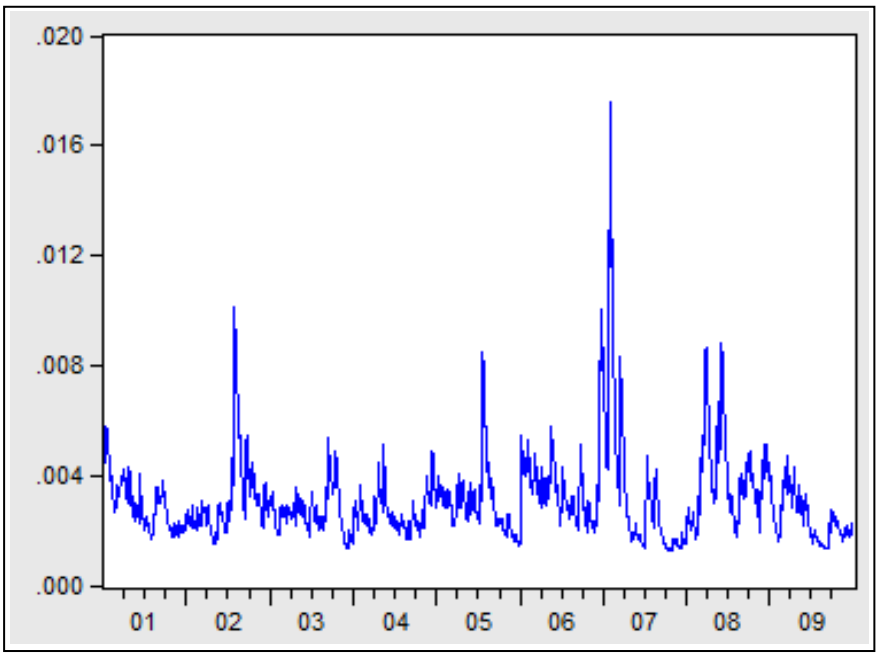


Figure8: Volatility of US Dollar (Logarithm)



3.3 The Stationarity Properties of Data

Before the analysis, the classical unit-root test, Augmented Dickey- Fuller (ADF) unit root test procedure, is used to test for nonstationarity of all variables. The testing equation is written as follows:

$$\Delta y_t = \gamma_0 + \lambda y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \varepsilon_i \qquad (11)$$

where y varies with the variables used in FDI section comprised the overall FDI, FDI in each industry, Real MPI, Interest Rate, The Real Barclays Capital EERs, The Japanese Yen, as well as The US Dollar. ε_i is the pure white noise error term. The lag length (p) can be specified by Akaike Information Criterion (AIC). In order to identify the optimal AR lags, the AIC equation is used as follows:

$$AIC = T\ ln\ (\sum \varepsilon_t^2) + 2n \qquad (12)$$

where n is the number of parameters estimated (p +q + possible constant term), and T is the number of usable observations.

As AIC equation measures squared deviations of the mean model, the lowest AIC implies a good fit model. After completed these steps, it can be ensured that all tested variables are stationary.

Table6: ADF Unit root tests

Variables	Lag Length	t-statistics
FDI in All industries	5	0.7614**
FDI in Manufacturing	1	-5.4254**
Durables Goods	1	-5.1195**
- Construction Materials	0	-10.0540**
- Machinery and Transportation Equipment	0	-11.0767**
- Electrical Appliances	1	-4.3552**
- Metal and Nonmetallic	0	-11.1639**
Nondurables Goods	2	-4.9898**
- Food and Sugar	1	-6.0966**
- Textiles	11	-4.0030*
- Chemicals	0	-9.9001**
- Petroleum Products	4	0.1361**
FDI in Nonmanufacturing	1	-4.3164**
- Financial Institution	10	0.7077**
- Trade	1	-10.4190**
- Agriculture	7	0.2040**
- Construction	0	-9.7982**
- Mining and Quarrying	1	-4.4414**
- Investment	1	-5.1766**
- Services	0	-10.5536**
- Real Estates	2	-3.4916*
The Real Barclays Capital EERs	1	-10.3887**
The Japanese Yen	9	-16.1452**
The US Dollar	4	-20.3095**
Real MPI	11	-5.0133**
Interest Rate	3	-4.4825**

All ADF regression includes a constant and time trend.
** Coefficient is significant at the 1% level, * Coefficient is significant at the 5% level

Because monthly time series data are used in this part, the unit roots may plausibly exist in the data. In order to test for stationarity properties, this paper conducts Augmented-Dickey-Fuller (ADF) tests of up to twelve lags with constant and linear trend based on the null hypothesis that unit roots is presented in the time-series. The optimal lag length is selected on the basis of Akaike Information Criterion (AIC) to solve for heteroskedasticity and serial correlation problems. The output of ADF tests for each variable used in this empirical analysis are shown in Table 6 in forms of t-statistics. Most of series are statistically significant at the 1% level, except the variable FDI in textiles and real estates industries which are significant at the 5% level. For those variables including with FDI in all industries,

petroleum products, financial institution, agriculture, and interest rate that are not level stationary, the regressions are estimated in terms of both level and first differences.

CHAPTER IV

METHODOLOGY

The methodology of this study can be divided into three sections. The estimating equation used in the analysis of the linkage between exchange rate movements, exchange rate risk, and the overall foreign direct investment are shown in the first section. The second section explains the testing equation of the relationship between exchange rate movements, exchange rate risk, and foreign direct investment at industry level and the testing equation of the relation between exchange rate movements, exchange rate risk, and portfolio investment at firm-specific level are described in the last section.

4.1 The Relation between Exchange Rate Movements, Exchange Rate Risk, and Foreign Direct Investment

4.1.1 The Model of the Overall Foreign Direct Investment

In this part, I investigate the impact of exchange rate movements and exchange rate risk on the overall foreign direct investment based on times series data method. The estimating model can be expressed as:

$$FDI_t = \propto_0 + \propto_1 FDI_{t-1} + \propto_2 \Delta REER_t + \propto_3 \Delta REER_{t-6} + \propto_4 \Delta REER_{t-12}$$
$$+ \propto_5 MPI_t + \propto_6 r_t + \propto_7 \sigma_t + \propto_8 \sigma_{t-6} + \propto_9 \sigma_{t-12} + \varepsilon_t \qquad (13)$$

where FDI_t is the overall FDI at time t

FDI_{t-1} denotes lagged one month overall FDI. The optimal lag is specified based on Akaike Information Criterion (AIC). In this case, lagged one month FDI is used as a proxy of FDI in the previous period since it generates the lowest AIC, according to the Table 7.

Table7: Optimal lag selected by AIC

AR	(1)	(2)	(3)	(4)	(5)
FDI	-5.7639	-5.3551	-5.3481	-5.3090	-5.3253

$\Delta REER_t$ represents the log return of real exchange rate. Depreciation in home country currency tends to stimulate direct investment response; as a result, the coefficient on REER is likely to be negative.

σ_t is the measure of real exchange rate volatility. This variable is constructed by GARCH (1,1) model. The linkage between FDI in each sector and exchange rate volatility is dependent on a degree of openness of each industry to global markets; therefore, the effect is predicted to be sector specific.

$\Delta REER_{t-6}$, $\Delta REER_{t-12}$, σ_{t-6} , and σ_{t-12} is defined as lagged six month real effective exchange rate, lagged twelve month real effective exchange rate, lagged six month volatility of exchange rate, and lagged twelve month volatility of exchange rate, respectively. I choose these time lags based on the fact that FDI is tied to real investment in permanent projects; therefore, it generally takes long time to generate revenues to investors. Thus, the real effective exchange rate movements as well as its volatility in many months ago or long term real effective exchange rate movements and its volatility should also determine the arrival of FDI in the present period.

MPI_t is the real manufacturing production index. The MPI is included in explanatory variables as it can directly reflect the production of each industry. Moreover, it corresponds with the dependent variable, FDI, which is analyzed by industry-level. The relationship between this variable and FDI is predicted to be positive.

r_t is the cost of capital. The cost of capital which is calculated by 3-month Thailand Treasury bill rate is another influential variable that also affects the level of direct investment as a rise in cost of capital is expected to discourage foreign direct investment flows.

ε_t is the residual term.

4.1.2 The Model of Foreign Direct Investment by Sector

In this part, I examine the relationship between exchange rate movements, exchange rate risk and foreign direct investment at industry-specific level by using times series data method.

In the case of FDI at industry-specific level, the variable FDI_t in equation (13) is substituted by FDI_t^i represented for FDI in sector i at time t. Also, FDI_{t-1} is removed and subsequently replaced by FDI_{t-1}^i indicated lagged one month FDI in sector i instead. Thus, the estimating equation can be written as follows:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta REER_t + \alpha_3^i \Delta REER_{t\text{-}6} + \alpha_4^i \Delta REER_{t\text{-}12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t + \alpha_8^i \sigma_{t\text{-}6} + \alpha_9^i \sigma_{t\text{-}12} + \varepsilon_t \quad (14)$$

where FDI_t^i represents FDI in sector i at time t

4.1.3 The Japanese Yen and US Dollar

4.1.3.1 The Model of the Overall Foreign Direct Investment

Since this paper also takes the bilateral exchange rates including with the Japanese Yen as well as the US Dollar into consideration; as a result, in order to investigate the impact of the Japanese Yen movements and JPY volatility on the overall foreign direct investment, the variable $\Delta REER_t$, $\Delta REER_{t\text{-}6}$, $\Delta REER_{t\text{-}12}$ in equation (13) are replaced by ΔJPY_t, $\Delta JPY_{t\text{-}6}$, $\Delta JPY_{t\text{-}12}$ which represent the log return of the Japanese Yen with respect to Thai Baht. Therefore, a rise in the value of this variable refers to depreciation of the Japanese Yen against Thai Baht. Also, the variable σ_t, $\sigma_{t\text{-}6}$, and $\sigma_{t\text{-}12}$ in equation (13) are replaced by σ_t^{JPY}, σ_{t-6}^{JPY}, and σ_{t-12}^{JPY} which denote for the measure of the Japanese Yen volatility.

Similarly, in case of US currency, in order to find the effect of the US Dollar and its volatility on the overall foreign direct investment, the variable ΔUSD_t, $\Delta USD_{t\text{-}6}$, $\Delta USD_{t\text{-}12}$, σ_t^{USD}, σ_{t-6}^{USD}, and σ_{t-12}^{USD} are plugged in equation (13) instead of $\Delta REER_t$, $\Delta REER_{t\text{-}6}$, $\Delta REER_{t\text{-}12}$, , σ_t , $\sigma_{t\text{-}6}$, and $\sigma_{t\text{-}12}$ where ΔUSD_t represents the log return of US Dollar relative to Thai Baht. An increase in the value of this term means the US Dollar depreciation against Thai Baht. As for the variable σ_t^{USD}, it is the measure of the USD volatility.

After completed this process, we are able to find out the impact of the movements of Japanese Yen, US Dollar, and their volatilities on the overall flows of foreign direct investment.

4.1.3.2 The Model of the Foreign Direct Investment by Sector

To investigate the effect of the bilateral exchange rates consisted of the Japanese Yen and US currency on FDI in each industry; the equation (14) is repeatedly regressed by different industries.

4.2 The Relation between Exchange Rate Movements, Exchange Rate Risk, and Portfolio Investment at Firm-specific Level

4.2.1 The Model of Portfolio Investment at Firm-specific Level

In this section, I investigate the individual firm-specific international portfolio investment responsiveness to exchange rate movement and exchange rate risk by using firm-level panel data technique.

Initially, this study predicted that the foreign equity trading would differently response to exchange rate movement and exchange rate risk due mainly to the specific characteristics of each individual firm. Therefore, the fixed effect in panel data method is introduced to capture the different reaction of firm-specific portfolio investment flows to exchange rate movement and exchange rate risk.

Nevertheless, it turns out to be opposite. Under the null hypothesis that there is no particular difference among idiosyncratic characteristics of each firm, the testing result does not reject the null hypothesis at any conventional levels. As a consequence, it may presumably say that firms' reaction to changes in exchange rate movement and exchange rate risk are significantly identical. The estimated equation in this section is then regressed by using pooled OLS method with the assumption that there is no difference in character among firms instead of cross-sectional fixed effects. Aside from this, this paper estimates the testing equation based on the White test for heteroskedasticity (1980) instead of usual OLS standard errors in order to eliminate econometric problems.

In order to find the linkage between foreign equity flows at firm-specific level, exchange rate movements and exchange rate risk, the foreign portfolio investment by firm equation can be expressed as:

$$\begin{aligned} FORTRADE_{i,t} \quad = \quad & \alpha_i + \beta_1 SIZE_{i,t} + \beta_2 MVBV_{i,t} + \beta_3 RET_{i,t} + \beta_4 BETA_i \\ & + \beta_5 \Delta REER_t + \beta_6 \Delta REER_{t-1} + \beta_7 \Delta REER_{t-6} \\ & + \beta_8 \sigma_t + \beta_9 \sigma_{t-1} + \beta_{10} \sigma_{t-6} + \varepsilon_{i,t} \end{aligned} \qquad (15)$$

where $FORTRADE_{i,t}$ is the net foreign trading computed by foreign purchase minus foreign sale. This dependent variable is used as a proxy of firm-specific portfolio investment flows.

α_i indicates fixed effects in panel data method. The particular property of fixed effect is that it captures the individual firm-specific characteristics. In this study, fixed effect is introduced in order to explain the different responsiveness of foreign portfolio investment by firm to exchange rate movements and exchange rate risk.

$SIZE_{i,t}$ represents a size of firm i characteristics and years t. The coefficient of this variable is expected to be positive as firms with high market capitalization are generally more attractive in views of all types of investors.

$MVBV_{i,t}$ is market-to-book ratio. Based on the reason that larger firms with a high market-to-book ratio tend to generate lower returns when comparing with smaller firms with a low market-to-book ratio; therefore, the relationship is predicted to be negative.

$RET_{i,t}$ denotes stock returns. The linkage is anticipated to be positive simply because the higher the return on holding financial assets is, the larger the proportion of foreign investment in that asset.

$BETA_{i,t}$ is CAPM beta of the stock. This right-hand-side variable indicates the individual firm-specific systematic risk that cannot be able to diversify, as a result, the sign is forecasted to be negative.

The variables size, market-to-book ratio, stock returns, and CAPM beta of the stock are introduced as control variables for individual firm-specific foreign portfolio investment decisions. These variables reflect individual firm's characteristics.

$\Delta REER_t$ denotes log return of real exchange rate. Because a depreciation of local currency raises the wealth of international investors, this study then predicts that the lower value of domestic currency enhances the demand for domestic financial assets; thereby increasing the overall foreign portfolio investment flows to Thailand.

σ_t is real exchange rate volatility. This variable is constructed by GARCH (1,1) model. The link between exchange rate volatility and firm-specific foreign portfolio flows are expected to be negative since most of firms also take into account the uncertainty of exchange rate as an additional source of risk, thereby shifting away the participation of international investors to other steady economies. Nevertheless, the effect of exchange rate variability on foreign portfolio flows in each individual firms are likely to be distinguished as it critically depends on the firms' exposure with the external exposures.

$\Delta REER_{t-1}$, $\Delta REER_{t-6}$, σ_{t-} , and σ_{t-6} represent lagged one month real effective exchange rate, lagged six month real effective exchange rate, lagged one month volatility of exchange rate, and lagged six month volatility of exchange rate, respectively. In the viewpoint of international investors, portfolio investment is also known as hot money or temporary investment. Foreign investors usually allocate their savings into portfolio investment in order to obtain temporarily extra gains from diversification. As a result, the real effective exchange rate movements and its volatility in short period are possibly powerful in determining the inflows of portfolio investment at current period.

This paper mainly considers the exchange rate movements and exchange rate volatility variables on the basis that the impact of exchange rate movements and its volatility on individual firm-specific foreign equity investment flows is different from firm to firm.

$\varepsilon_{i,t}$ is an error term.

To estimate the effect of exchange rate movements and exchange rate risk on portfolio flows at individual firm-specific level, we estimate the equation (15).

4.2.2 The Japanese Yen and US Dollar

Consistent to the FDI section, $\Delta REER_t$, $\Delta REER_{t-1}$, $\Delta REER_{t-6}$, σ_t ,σ_{t-1} , and σ_{t-6} in the equation (15) are substituted by ΔJPY_t, ΔJPY_{t-1}, ΔJPY_{t-6}, σ_t^{JPY} , σ_{t-1}^{JPY} , and σ_{t-6}^{JPY} .

In the presence of US currency, corresponding with the first section $\Delta REER_t$, $\Delta REER_{t-1}$, $\Delta REER_{t-6}$, σ_t , σ_{t-1} , and σ_{t-6} in equation (15) are removed and subsequently turned to the variable ΔUSD_t, ΔUSD_{t-1}, ΔUSD_{t-6}, σ_t^{USD}, σ_{t-1}^{USD}, and σ_{t-6}^{USD} instead.

So far, we can then estimate the link of Japanese Yen, US Dollar, their volatilities, and portfolio flows at individual firm-specific level.

CHAPTER V

EMPIRICAL RESULTS

In this chapter, there are altogether six main parts: the result from estimating the effect of exchange rate movements and exchange rate risk on the overall flows of FDI and FDI by sector, the output from examining the effect of Japanese Yen movements and Japanese Yen volatility on the overall flows of FDI and FDI by sector, the result regarding the effect of US Dollar movements and US Dollar volatility on the overall flows of FDI and FDI by sector, the result concerning the effect of exchange rate movements and exchange rate risk on portfolio investment by firm, the result with regard to the effect of Japanese Yen movements and Japanese Yen volatility on portfolio investment by firm, and finally, the result related with the effect of US Dollar movements and US Dollar volatility on portfolio investment by firm.

5.1 The Effect of Exchange Rate Movements and Exchange Rate Risk on Foreign Direct Investment

5.1.1 The Effect of Exchange Rate Movements and Exchange Rate Risk on the Overall Flows of Foreign Direct Investment

The analysis of this section begins by providing some statistics on the exposure coefficients of each sector. As anticipated earlier, the exposure coefficients vary in sign and magnitude across sixteen sectors.

The estimation outputs from equation (13) are shown in Table 8. The crucial variables are $\Delta REER_t$, $\Delta REER_{t-6}$, $\Delta REER_{t-12}$, σ_t , σ_{t-6}, σ_{t-12} referring to the movement of exchange rate and exchange rate risk at each point in time.

For the overall FDI, the coefficient on $\Delta REER_{t-6}$ is estimated as -3.6133 and marginally significant at 10% indicating that the overall FDI is affected by exchange rate movements. From this result, it can be concluded that a depreciation of Thai Baht with respect to other currencies in the basket brings about the desirable effect simply because it significantly increases the overall FDI in Thailand. This finding is in line with the hypothesis and could be supported by the reason from the paper of Campa and Goldberg (1999) suggested that depreciation of domestic currency lowers the domestic currency value of domestic exports in

terms of foreign export price, thereby expanding the volume and revenue of exporting activities and finally enhancing the level of investment.

As for the relation between exchange rate risk and the overall FDI, it plays no role in explaining aggregate FDI inflows. This result is opposite to our hypothesis; however, it should be interpreted with the reason that FDI is classified as cold money or a safe form of investment compared to portfolio flows as it is bound to real investment in plant, equipment, and technology, whereas portfolio inflows may be categorized as temporary investment aimed at profit speculation. Therefore, the overall FDI flows may not be well-explained by the exchange rate risk.

5.1.2 The Effect of Exchange Rate Movements and Exchange Rate Risk on Foreign Direct Investment in Manufacturing Sector

For the impact of exchange rate movements on FDI in manufacturing category, the $\Delta REER_t$ coefficient is 1.1123 in manufacturing durables goods, and 1.0341 in machinery and transportation equipment sector which all are significant at 1% level. Also, in chemicals sector, the coefficient on $\Delta REER_{t-6}$ is positively significant. However, there is also the opposite impact of exchange rate movements on FDI in textiles sector, the coefficient on $\Delta REER_{t-12}$ is estimated as -0.0830 with 5% significance level.

It is of interest to see that most of the significant effects are likely to be positive. As a consequence, it could interpret that depreciation of Thai Baht against other currencies tends to lower the inflows of FDI in manufacturing sector. This empirical finding is consistent with the earlier prediction and could be supported by the study of Campa and Goldberg (1999) which describes that depreciation of local currency increases domestic prices, in respond to a rise in competing imported goods. This increase in price then decreases the revenue as well as wealth, and eventually negatively affects the firms' profitability and investment level. This channel is called the wealth effect channel. Further, domestic currency depreciation increases domestic costs of imported intermediate inputs and this then consequently reduce the marginal profitability and the level of investment.

Turning to the link between exchange rate risk and FDI at industry-specific level, the estimated coefficients for FDI in manufacturing durable goods, machinery and transportation equipment, and chemicals sectors are all negatively significant; while the relation turns to be

opposite for FDI in petroleum industry. In food and sugar industry, the negative effect is stronger than the positive effect.

Thus, it is apparently seen that the linkage between FDI in most of industries typed as manufacturing and exchange rate risk tend to be negative. These negative impacts are supported by Landon and Smith (2009), their paper reveals that an increase in exchange rate risk leads to the unpredictable cost of imported inputs and shares of foreign sales in total sales, resulting in a fall in direct investment in the manufacturing sector. For positive impact, it might be described by the reason that foreign investors longer engage in FDI in order to avoid the exchange rate risk which is the cost of international trade, according to Markusen (1995).

So far, we now have seen that the exposure coefficients of exchange rate movements and exchange rate risk vary in sign and magnitude across FDI in manufacturing sector. These notable findings are consistent with the earlier expectation in the sense that manufacturing industry is naturally dependent on external exposures; as a result, exchange rate movements and exchange rate risk then largely influence FDI in manufacturing industry.

5.1.3 The Effect of Exchange Rate Movements and Exchange Rate Risk on Foreign Direct Investment in Nonmanufacturing Sector

Regarding the impact of exchange rate movements on FDI in nonmanufacturing category, the $\Delta REER_t$ coefficient is positively significant in investment industry. However, there is also the opposite impact of exchange rate movements on FDI in financial institution sector.

Concerning the effect of exchange rate risk, the coefficients for FDI in financial institution sector, mining and quarrying, as well as service industry are all positively significant.

As interpreted above, the inflows of FDI in investment, financial institution, mining and quarrying, and service sectors which all are typed as nonmanufacturing are also determined by the movements of exchange rate and exchange rate risk. These noteworthy results are contrary to our hypothesis; nonetheless, they might possibly be explained by the reason of the degree of reliance on external finance of each industry on the ground that FDI in the aforementioned industry are heavily supported by external source of funds and less driven by internal finance. Thus, exchange rate movements and exchange rate risk consequently impact

the inflows of foreign investment in these sectors, even though they are categorized as nonmanufacturing category.

5.1.4 Diagnostic Test

According to Table 8, the R-squared statistics range during twenty to forty percent. This reflects that approximately twenty to forty percent of the variation in dependent variable could be moderately explained by the independent variables. The Jarque-Bera Statistics is employed in order to test the normality property of residuals. Under the null hypothesis that the residuals are normally distributed, the Jarque-Bera Statistics show that the residuals are non-normally distributed. Besides, the correlogram Q-statistics and correlogram squared residuals are introduced in order to test serial-correlation and heteroskedastic problems. The results reveal that the correlogram Q-statistics and correlogram squared residuals of most variables are statistically insignificant implying that the serial correlations and heteroskedasticity do not appear in most of the residuals; therefore, it seems to show that the model is well-specified.

5.2 The Effect of Japanese Yen Movements and Japanese Yen Volatility on Foreign Direct Investment

5.2.1 The Effect of Japanese Yen Movements and Japanese Yen Volatility on the Overall Flows of Foreign Direct Investment

The outputs from estimating the link between the Japanese Yen movements, the Japanese Yen volatility, and the overall flows of foreign direct investment are presented in Table 9. The variable ΔJPY_t, ΔJPY_{t-6}, ΔJPY_{t-12}, σ_t^{JPY}, σ_{t-6}^{JPY}, and σ_{t-12}^{JPY} are specially highlighted.

It can be summarized that at the overall FDI, there is a significantly negative linkage between the Japanese Yen and sectoral FDI flows to Thailand. This finding indicates that an appreciation of Thai Baht against the Japanese Yen decreases foreign investors' attention; thereby moving their long term fund flows away from Thailand and lowering the inflows of the overall FDI. Additionally, it is in line with our hypothesis and could be explained by the suggestion from Campa and Goldberg (1999) on the ground that foreign investors naturally prefer moving their endowment into the country that depreciates their home currency simply because local currency depreciation leads to a rise in foreign demand for exported output; therefore, domestic exchange rate depreciation is basically desirable for all types of investors.

Table8: Estimated Coefficients, α_i

FDI_t^i	α	FDI_{t-1}^i	$\Delta REER_t$	$\Delta REER_{t-6}$	$\Delta REER_{t-12}$	MPI	r	σ_t	σ_{t-6}	σ_{t-12}	R^2	JB	Q-$Stat$	Sq-$Residuals$
All industries	0.0002	-0.6019***	3.1442	-3.6133*	-1.185	-0.0006	0.0059	1.3344	0.8953	0.6358	0.3989	31.7163***	11.159**	4.5998
	(0.0086)	(0.0858)	(2.1815)	(2.1788)	(2.1177)	(0.0007)	(0.0069)	(0.8507)	(0.8207)	(0.8479)				
Manufacturing	-0.0033	-0.1673**	0.55	0.3818	0.433	0.0011***	0.0032	-0.0356	-0.4087	0.5810**	0.3515	6.7251**	2.3042	16.707**
	(0.0027)	(0.1034)	(0.6896)	(0.6877)	(0.6763)	(0.0002)	(0.0022)	(0.2692)	(0.2624)	(0.2708)				
Durables Goods	0.0009	-0.1710**	1.1123***	-0.1597	0.3407	0.0006 ***	0.0023	-0.4234**	-0.0505	-0.119	0.2621	13.6672***	10.2920	1.9551
	(0.0019)	(0.1018)	(0.5019)	(0.4955)	(0.4859)	(0.0002)	(0.0016)	(0.1956)	(0.1887)	(0.1945)				
- Construction Materials	0.0001	-0.0067	-0.0338	-0.0277	0.0151	-0.0002	0.0001	0.007	0.0013	-0.0068	0.2040	16056***	3.0845	0.0675
	(0.0001)	(0.1089)	(0.0383)	(0.0375)	(0.0371)	(0.0001)	(0.0001)	(0.0148)	(0.0143)	(0.0148)				
- Machinery and	-0.0004	-0.0678	1.0341***	-0.2127	0.3433	0.0004 ***	-0.0004	-0.3773**	0.0496	-0.1045	0.4113	98.2431***	2.9204	16.3610
Transportation Equipment	(0.0016)	(0.1055)	(0.4209)	(0.4149)	(0.4113)	(0.0001)	(0.0013)	(0.1653)	(0.1586)	(0.1651)				
- Electrical Appliances	-0.0003	0.3852***	-0.3789	0.0373	0.1097	0.0001	0.0006	-0.0942	-0.0794	0.1017	0.2298	5.0334	15.691**	1.3922
	(0.0011)	(0.1092)	(0.284)	(0.2735)	(0.2687)	(0.0001)	(0.0009)	(0.1073)	(0.1056)	(0.1081)				
- Metal and Nonmetallic	0.0014	0.0493	0.1543	0.2727	-0.2515	-0.0001	0.0011**	0.06201	0.0669	-0.0251	0.4544	7.2772**	6.1124	0.3462
	(0.0007)	(0.1011)	(0.1685)	(0.1658)	(0.1639)	(0.0001)	(0.0005)	(0.0658)	(0.064)	(0.0662)				

This table reports the result of exposure coefficients regressed by the following two equations:

$$FDI_t = \propto_0 + \propto_1 FDI_{t-1} + \propto_2 \Delta REER_t + \propto_3 \Delta REER_{t-6} + \propto_4 \Delta REER_{t-12} + \propto_5 MPI_t + \propto_6 r_t + \propto_7 \sigma_t + \propto_8 \sigma_{t-6} + \propto_9 \sigma_{t-12} + \varepsilon_t$$

where FDI_t is the overall FDI, FDI_{t-1} denotes lagged one month overall FDI. The optimal lag is specified based on Akaike Information Criterion (AIC), $\Delta REER_t$ represents the log return of real exchange rate, σ_t is the measure of real exchange rate volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, $\Delta REER_{t-6}$, $\Delta REER_{t-12}$, σ_{t-6} , and σ_{t-12} is defined as lagged six month real effective exchange rate, lagged twelve month real effective exchange rate, lagged six month volatility of exchange rate, and lagged twelve month volatility of exchange rate, respectively. ε_t is the residual term.

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta REER_t + \alpha_3^i \Delta REER_{t-6} + \alpha_4^i \Delta REER_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t + \alpha_8^i \sigma_{t-6} + \alpha_9^i \sigma_{t-12} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC)

The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level, * Marginally significant at the 10% level

Table8: Estimated Coefficients, α_i (continued)

FDI_t^i	α	FDI_{t-1}^i	$\Delta REER_t$	$\Delta REER_{t-6}$	$\Delta REER_{t-12}$	MPI	r	σ_t	σ_{t-6}	σ_{t-12}	R^2	JB	Q-Stat	Sq-Residuals
Nondurables Goods	0.0044	-0.2528***	0.2251	0.8064**	-0.1229	-0.0002	0.0006	0.075	-0.0445	0.0448	0.2537	33.8794***	8.0648	6.7773
	(0.0015)	(0.1032)	(0.3695)	(0.3660)	(0.3646)	(0.0001)	(0.0011)	(0.1442)	(0.1394)	(0.1438)				
- Food and Sugar	0.0008	-0.1861**	-0.1823	0.0116	0.1068	-0.0034	0.0001	-0.2609***	0.1876**	0.1367	0.2723	467.4476***	3.5746	0.5668
	(0.0008)	(0.1105)	(0.2200)	(0.2155)	(0.2127)	(0.0006)	(0.0006)	(0.0889)	(0.0847)	(0.0875)				
- Textiles	0.0001	0.0844	0.0429	0.0202	-0.0830**	0.0002	0.0001	-0.0107	0.0088	-0.0145	0.2620	27.7133***	4.4473	0.8772
	(0.0001)	(0.1107)	(0.0323)	(0.0314)	(0.0311)	(0.0001)	(0.001)	(0.0125)	(0.0120)	(0.0124)				
- Chemicals	0.0029	0.0161	0.057	0.6572***	0.0752	-0.0002	-0.0001	-0.1749**	-0.4182***	0.0533	0.3779	451.6303***	3.5289	13.437**
	(0.0009)	(0.0947)	(0.2308)	(0.2281)	(0.2261)	(0.0001)	(0.0007)	(0.0900)	(0.0869)	(0.0897)				
- Petroleum products	0.0001	-0.3668***	0.2795	0.2859	0.2685	-0.0001**	0.0015**	0.2246**	0.2871**	0.0873	0.2993	1182.16***	1.2834	1.7862
	(0.0009)	(0.0948)	(0.2451)	(0.2460)	(0.2375)	(0.0001)	(0.0007)	(0.0962)	(0.0922)	(0.0951)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta REER_t + \alpha_3^i \Delta REER_{t-6} + \alpha_4^i \Delta REER_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t + \alpha_8^i \sigma_{t-6} + \alpha_9^i \sigma_{t-12} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), $\Delta REER_t$ represents the log return of real exchange rate, σ_t is the measure of real exchange rate volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, $\Delta REER_{t-6}$, $\Delta REER_{t-12}$, σ_{t-6} , and σ_{t-12} is defined as lagged six month real effective exchange rate, lagged twelve month real effective exchange rate, lagged six month volatility of exchange rate, and lagged twelve month volatility of exchange rate, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table8: Estimated Coefficients, α_i (continued)

FDI_t^i	α	FDI_{t-1}^i	$\Delta REER_t$	$\Delta REER_{t-6}$	$\Delta REER_{t-12}$	MPI	r	σ_t	σ_{t-6}	σ_{t-12}	R^2	JB	Q-$Stat$	Sq-$Residuals$
Nonmanufacturing	-0.0053	0.1486	3.6474 **	-0.3411	-1.5535	0.0001	0.0081	2.1423***	1.2961	-0.324	0.2002	127.9895***	7.0287	4.2225
	(0.0075)	(0.1032)	(1.8984)	(1.88)	(1.8509)	(0.0006)	(0.006)	(0.7535)	(0.7183)	(0.7429)				
- Financial	-0.0001	-0.4218***	-0.7602	-1.7983***	-1.2675**	-0.0003	0.0044	0.7391***	0.1462	0.4986	0.3295	21.2635***	22.771**	2.2056
Institution	(0.0027	(0.0902	(0.6991	(0.6884	(0.6817	(0.0002	(0.0022	(0.2745	(0.2635	(0.2737)				
- Trade	0.0056	-0.2437**	0.34448	-0.7134	-1.412	-0.0003	-0.0022	-0.3035	0.5027	-0.1599	0.2036	335.2185***	9.0996	18.573**
	(0.0047)	(0.1043)	(1.2045)	(1.1797)	(1.1613)	(0.0004)	(0.0038)	(0.4663)	(0.45)	(0.4647)				
- Agriculture	-0.0001	-0.6087***	-0.0117	-0.0155	-0.0001	0.0003	0.0001	0.0054	0.0005	0.0012	0.3691	640.9377***	18.881***	5.6011
	(0.0001)	(0.0879)	(0.022)	(0.0217)	(0.0214)	(0.0006)	(0.0002)	(0.0086)	(0.0083)	(0.0085)				
- Construction	0.0005	-0.0571	0.009	0.0589	-0.0764	-0.0004**	-0.0005**	0.0035	-0.0008	0.0473	0.2100	4811.906***	3.5974	0.0954
	(0.0003)	(0.1113)	(0.082)	(0.0781)	(0.0778)	(0.0001)	(0.0002)	(0.0311)	(0.0299)	(0.0311)				
- Mining and	-0.0002	0.0399	0.4061	0.106	-0.1085	-0.0002	0.0003	0.4443**	0.1001	-0.0286	0.2184	8.9029**	5.5706	1.4149
Quarrying	(0.001)	(0.112)	(0.2728)	(0.2681)	(0.2669)	(0.0001)	(0.0008)	(0.1169)	(0.1029)	(0.106)				
- Investment	-0.0041	-0.1921**	2.6970***	0.2447	0.664	0.0004	0.0038	0.1529	0.0366	-0.4761	0.2612	2143.111***	9.2083	8.0934
	(0.004)	(0.1014)	(1.007)	(0.9949)	(0.9781)	(0.0003)	(0.0032)	(0.3922)	(0.3787)	(0.3924)				
- Services	0.0023	-0.1494	0.1045	0.3957	0.4624	-0.0002	0.0009	0.158	0.5301***	0.0469	0.3940	35.8328***	0.8334	3.5566
	(0.0021)	(0.1126)	(0.527)	(0.5196)	(0.5219)	(0.0002)	(0.0016)	(0.2057)	(0.2084)	(0.2051)				
- Real estates	-0.0055	0.1758**	-0.3209	-0.204	-0.1603	0.0003***	-0.0009	0.1941	0.1364	0.1795	0.4239	56.9201***	6.4775	0.5590
	(0.0013)	(0.1039)	(0.2876)	(0.2833)	(0.2816)	(0.0001)	(0.0009)	(0.1142)	(0.1083)	(0.1134)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta REER_t + \alpha_3^i \Delta REER_{t-6} + \alpha_4^i \Delta REER_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t + \alpha_8^i \sigma_{t-6} + \alpha_9^i \sigma_{t-12} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), $\Delta REER_t$ represents the log return of real exchange rate, σ_t is the measure of real exchange rate volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, $\Delta REER_{t-6}$, $\Delta REER_{t-12}$, σ_{t-6} , and σ_{t-12} is defined as lagged six month real effective exchange rate, lagged twelve month real effective exchange rate, lagged six month volatility of exchange rate, and lagged twelve month volatility of exchange rate, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table 9: Estimated Coefficients, α_i

FDI_t^i	α	FDI_{t-1}^i	ΔJPY_t	ΔJPY_{t-6}	ΔJPY_{t-12}	MPI	r	σ_t^{JPY}	σ_{t-6}^{JPY}	σ_{t-12}^{JPY}	R^2	JB	Q-$Stat$	Sq-$Residuals$
All industries	0.0019	-0.5810***	-2.1968**	1.7405	1.6641	-0.0002	0.0013	0.2826	-0.5563	0.5053	0.4008	35.2952***	8.1691	4.2904
	(0.0087)	(0.0852)	(1.3073)	(1.3765)	(1.3772)	(0.0007)	(0.0074)	(0.8702)	(0.8373)	(0.8562)				
Manufacturing	-0.0034	-0.1796***	-0.3161	1.0701***	0.5228	0.0013***	0.003	0.1512	-0.4813**	-0.0613	0.3468	42.2798***	3.8823	12.188**
	(0.0028)	(0.1032)	(0.4162)	(0.4502)	(0.4375)	(0.0002)	(0.0023)	(0.2775)	(0.2681)	(0.2734)				
Durables Goods	0.0007	-0.1611	-0.5337	0.3201	0.1883	0.0006***	0.002	-0.2863	-0.0323	0.0289	0.3610	15.9114***	14.4980	2.4384
	(0.0020)	(0.1033)	(0.3011)	(0.3191)	(0.3166)	(0.0002)	(0.0017)	(0.1994)	(0.1926)	(0.1976)				
- Construction Materials	0.0001	0.0133	0.0163	0.0183	0.0082	-0.0003	0.0001	0.0048	-0.0072	-0.0072	0.2024	16687.39***	3.4965	0.0751
	(0.0001)	(0.1082)	(0.0229)	(0.0241)	(0.0241)	(0.0002)	(0.0001)	(0.0151)	(0.0147)	(0.0150)				
- Machinery and	-0.0016	-0.2335**	-0.6893***	0.0265	0.059	0.0003**	-0.0002	-0.3296**	0.2344	0.4508***	0.4528	92.9912***	4.2413	22.9980
Transportation Equipment	(0.0015)	(0.1004)	(0.2292)	(0.2404)	(0.2409)	(0.0001)	(0.0012)	(0.1551)	(0.1494)	(0.1521)				
- Electrical Appliances	-0.0001	0.2810**	0.1779	0.1132	0.0052	0.0002**	0.0005	-0.0135	-0.151	-0.1057	0.2440	2.9122	10.099**	1.6457
	(0.001)	(0.1134)	(0.1643)	(0.1782)	(0.1721)	(0.0001)	(0.0009)	(0.1100)	(0.1077)	(0.1114)				
- Metal and Nonmetallic	0.0018	0.0186	0.0214	-0.0106	0.1517	0.0001	0.0007	-0.051	0.0091	-0.1465***	0.3466	31.5688***	3.6248	0.5061
	(0.0007)	(0.1069)	(0.1017)	(0.1065)	(0.1084)	(0.0001)	(0.0005)	(0.0674)	(0.0651)	(0.0682)				

This table reports the result of exposure coefficients regressed by the following two equations:

$$FDI_t = \propto_0 + \propto_1 FDI_{t-1} + \propto_2 \Delta JPY_t + \propto_3 \Delta JPY_{t-6} + \propto_4 \Delta JPY_{t-12} + \propto_5 MPI_t + \propto_6 r_t + \propto_7 \sigma_t^{JPY} + \propto_8 \sigma_{t-6}^{JPY} + \propto_9 \sigma_{t-12}^{JPY} + \varepsilon_t$$

where FDI_t is the overall FDI, FDI_{t-1} denotes lagged one month overall FDI. The optimal lag is specified based on Akaike Information Criterion (AIC), ΔJPY_t represents the log return of Japanese Yen against Thai Baht, σ_t^{JPY} is the measure of Japanese Yen volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔJPY_{t-6} , ΔJPY_{t-12}, σ_{t-6}^{JPY}, and σ_{t-12}^{JPY} is defined as lagged six month Japanese Yen, lagged twelve month Japanese Yen, lagged six month volatility of Japanese Yen, and lagged twelve month volatility of Japanese Yen, respectively. ε_t is the residual term.

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta JPY_t + \alpha_3^i \Delta JPY_{t-6} + \alpha_4^i \Delta JPY_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{JPY} + \alpha_8^i \sigma_{t-6}^{JPY} + \alpha_9^i \sigma_{t-12}^{JPY} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC)

The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table 9: Estimated Coefficients, α_i (continued)

FDI_t^i	α	FDI_{t-1}^i	ΔJPY_t	ΔJPY_{t-6}	ΔJPY_{t-12}	MPI	r	σ_t^{JPY}	σ_{t-6}^{JPY}	σ_{t-12}^{JPY}	R^2	JB	Q-$Stat$	Sq-$Residuals$
Nondurables Goods	0.0046	-0.2927**	-0.1017	0.1218	0.2466	-0.0001	0.0002	-0.0934	-0.0572	-0.0231	0.2197	71.3511***	13.031**	14.287**
	(0.0015)	(0.1038)	(0.2267)	(0.2381)	(0.2384)	(0.0001)	(0.0012)	(0.1502)	(0.1452)	(0.1484)				
- Food and Sugar	0.0006	-0.0235	0.0464	-0.018	0.0952	-0.0016	0.0001	-0.0276	0.0596	-0.0168	0.2144	277.4908***	3.8021	1.5565
	(0.0009)	(0.1096)	(0.1435)	(0.1502)	(0.1507)	(0.0004)	(0.0008)	(0.0950)	(0.0919)	(0.0940)				
- Textiles	0.0001	0.1088	-0.0317	-0.0282	0.0134	-0.0006	0.0001	0.0005	0.0037	0.0061	0.3140	31.0374***	5.4138	1.3449
	(0.0001)	(0.1121)	(0.0198)	(0.0206)	(0.0207)	(0.0001)	(0.0001)	(0.0130)	(0.0126)	(0.0130)				
- Chemicals	0.0024	-0.003	0.0545	0.185	0.0865	-0.0004	0.0004	-0.0773	-0.1262	0.0633	0.2728	5789.94***	2.4884	0.3892
	(0.0011)	(0.1111)	(0.1620)	(0.1733)	(0.1702)	(0.0001)	(0.0009)	(0.1069)	(0.1035)	(0.1057)				
- Petroleum products	0.0001	-0.3826**	0.1108	0.0845	0.0257	-0.0001	0.0013	0.0881	0.0806	-0.0502	0.2831	527.1513***	7.8575	9.2678
	(0.0010)	(0.0997)	(0.1583)	(0.1664)	(0.1664)	(0.0001)	(0.0008)	(0.1050)	(0.1022)	(0.1037)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta JPY_t + + \alpha_3^i \Delta JPY_{t-6} + \alpha_4^i \Delta JPY_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{JPY} + \alpha_8^i \sigma_{t-6}^{JPY} + \alpha_9^i \sigma_{t-12}^{JPY} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), ΔJPY_t represents the log return of Japanese Yen against Thai Baht, σ_t^{JPY} is the measure of Japanese Yen volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔJPY_{t-6} , ΔJPY_{t-12}, σ_{t-6}^{JPY} , and σ_{t-12}^{JPY} is defined as lagged six month Japanese Yen, lagged twelve month Japanese Yen, lagged six month volatility of Japanese Yen, and lagged twelve month volatility of Japanese Yen, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table 9: Estimated Coefficients, α_i (continu

FDI_t^i	α	FDI_{t-1}^i	ΔJPY_t	ΔJPY_{t-6}	ΔJPY_{t-12}	MPI	r	σ_t^{JPY}	σ_{t-6}^{JPY}	σ_{t-12}^{JPY}	R^2	JB	Q-Stat	Sq-Residuals
Nonmanufacturing	-0.0005	0.1262	-1.6945	-0.5773	0.1702	0.0011	0.0062	0.2426	-0.7369	-0.8814	0.2513	119.269***	5.0237	2.2479
	(0.0079)	(0.1133)	(1.1763)	(1.2429)	(1.2583)	(0.0006)	(0.0067)	(0.7832)	(0.7558)	(0.7802)				
- Financial	0.0004	-0.3943***	-0.0698	0.577	0.3696	-0.0002	0.006	0.3775	-0.337	0.4005	0.2289	29.9835***	20.927**	8.6580
Institution	(0.003)	(0.1008)	(0.4555)	(0.4729)	(0.4952)	(0.0002)	(0.0025)	(0.2996)	(0.2894)	(0.301)				
- Trade	0.0071	-0.2364**	0.2304	-0.0582	0.9193	-0.0001	-0.003	-0.414	0.1783	-0.2992	0.2888	297.0736***	9.5180	17.2850
	(0.0048)	(0.104)	(0.7238)	(0.758)	(0.7609)	(0.0004)	(0.0049)	(0.4801)	(0.464)	(0.474)				
- Agriculture	-0.0001	-0.6149***	0.0114	-0.0034	0.0016	-0.0003	0.0009	0.0009	0.002	0.0013	0.3709	637.0027***	18.648**	6.4066
	(0.0001)	(0.0877)	(0.0132)	(0.0139)	(0.0139)	(0.0069)	(0.0008)	(0.0087)	(0.0084)	(0.0086)				
- Construction	0.0004	-0.0475	0.0178	-0.0348	0.0377	-0.0037	-0.0007**	0.0005	-0.0095	0.0372	0.2164	4555.295***	4.3825	0.1108
	(0.0003)	(0.1066)	(0.0477)	(0.0498)	(0.05)	(0.0005)	(0.0007)	(0.0314)	(0.0304)	(0.0313)				
- Mining and	-0.0004	0.1855	-0.1769	-0.1929	-0.0204	-0.0033	0.0002	0.0741	0.1252	-0.0101	0.2829	13.3932***	12.418**	4.6466
Quarrying	(0.0011)	(0.111)	(0.1772)	(0.1875)	(0.1863)	(0.0002)	(0.0012)	(0.1174)	(0.1148)	(0.116)				
- Investment	-0.0039	-0.179	-1.1638	-0.5766	-0.5022	0.0004	0.0038	0.0237	-0.094	-0.2076	0.2365	2703.168***	9.2559	6.9554
	(0.0041)	(0.104)	(0.6162)	(0.642)	(0.6444)	(0.0003)	(0.0036)	(0.4086)	(0.3942)	(0.4029)				
- Services	0.0027	-0.154	0.0951	0.1423	-0.5786**	0.0001	-0.0026	-0.0333	-0.1222	-0.1583	0.2780	325.7987***	1.4249	0.3013
	(0.0021)	(0.117)	(0.3242)	(0.3366)	(0.3477)	(0.0002)	(0.0014)	(0.2134)	(0.2053)	(0.2119)				
- Real estates	-0.005	0.2205	-0.0001	0.013	-0.0118	0.0004***	-0.0015**	-0.0254	0.0541	0.0233	0.3735	66.5296***	6.8202	1.9491**
	(0.0014)	(0.1094)	(0.1802)	(0.1942)	(0.1936)	(0.0001)	(0.0012)	(0.1239)	(0.1154)	(0.1191)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta JPY_t + + \alpha_3^i \Delta JPY_{t-6} + \alpha_4^i \Delta JPY_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{JPY} + \alpha_8^i \sigma_{t-6}^{JPY} + \alpha_9^i \sigma_{t-12}^{JPY} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), ΔJPY_t represents the log return of Japanese Yen against Thai Baht, σ_t^{JPY} is the measure of Japanese Yen volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔJPY_{t-6} , ΔJPY_{t-12}, σ_{t-6}^{JPY}, and σ_{t-12}^{JPY} is defined as lagged six month Japanese Yen, lagged twelve month Japanese Yen, lagged six month volatility of Japanese Yen, and lagged twelve month volatility of Japanese Yen, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

5.2.2 The Effect of Japanese Yen Movements and Japanese Yen Volatility on Foreign Direct Investment in Manufacturing Sector

With regard to the movement of Japanese Yen, the output shows that the parameter for ΔJPY_t is negatively significant for FDI in machinery and transportation equipment industry. This can be implied that Thai Baht appreciation relative to the Japanese Yen induces foreign investors to flow their funds away from Thailand, resulting in a decline of the inflows of FDI in machinery and transportation equipment sector. This result is corresponding with our hypothesis and the paper of Campa and Goldberg (1999) suggested that depreciation of domestic currency reduces the domestic currency value of domestic exports in terms of foreign export price, thereby driving up the volume and revenue of exporting activities and finally increasing the level of investment.

As for the Japanese Yen volatility, the testing results show that in metal and nonmetallic sector, the relation appears to be negative. Nonetheless, for FDI in machinery and transportation equipment sector, the positive impact dominates the negative impact.

These findings lead to the conclusion that the effect of Japanese Yen volatility on FDI in manufacturing category is ambiguous. It can be either positive or negative, depending on the exposure of each industry to world market.

Further, it is noticeable that of the four categories of FDI in manufacturing durables, the results show that two of these, metal and nonmetallic, and machinery and transportation equipment are statistically significant affected by the movements of Japanese Yen as well as its volatility. These noteworthy results are corresponding with the data from the Board of Investment shown in Figure 3 suggested that FDI in both metal and nonmetallic as well as machinery and transportation equipment are largely funded by Japanese investors; as a result, the movement of Japanese Yen and its variability then have high explanatory power on the inflows of FDI in these two industries when compared with other currencies.

Comparing with the estimated results by using the Real Effective Exchange Rate, it is obviously seen that the Japanese Yen generates stronger effects on FDI in manufacturing durables category. Therefore, this result leads to the conclusion that the inflows of FDI in manufacturing durables category to Thailand is well-explained by the Japanese Yen.

5.2.3 The Effect of Japanese Yen Movements and Japanese Yen Volatility on Foreign Direct Investment in Nonmanufacturing Sector

Concerning the impact of the movement of Japanese Yen, the output demonstrates that one of eight FDI in nonmanufacturing category is significantly influenced by the Japanese Yen movements. The approximate parameter of ΔJPY_{t-12} is negatively significant for FDI in service industry. This result means that depreciation of Japanese Yen reduces the inflows of FDI in service sector to Thailand.

Apparently seen, of the eight categories of FDI in nonmanufacturing, the results show that only one of these; services industry is statistically significant affected by the Japanese Yen movements. This finding may possibly be described by the reason of the degree of reliance on external finance of each industry on the ground that FDI in services industry is heavily supported by Japanese investors and less driven by internal finance. As a consequence, the Japanese Yen movements play a part in explaining the inflows of foreign investment in this sector, although it is categorized as nonmanufacturing category.

5.2.4 Diagnostic Test

Referring to Table 9, it can be summarized that the dependent variables can be well-predicted the value of dependent variable. When considering the econometric problems, the diagnostic test shows that the correlogram Q-statistics and correlogram squared residuals are insignificant implying that most of the residuals have no serial correlations and heteroskedasticity. Therefore, it seems to show that the model is well-specified. However, most of the residuals tend to be non-normally distributed.

5.3 The Effect of US Dollar Movements and US Dollar Volatility on Foreign Direct Investment

Table 10 shows the outputs from estimating the link between the US Dollar movements, the USD volatility, and foreign direct investment. This part emphasizes the variable ΔUSD_t, ΔUSD_{t-6}, ΔUSD_{t-12}, σ_t^{USD}, σ_{t-6}^{USD} ,and σ_{t-12}^{USD}. The results show that the different directions among the coefficients are occurred due to the industry-specific effects from the movements of US Dollar and its volatility.

5.3.1 The Effect of US Dollar Movements and US Dollar Volatility on Foreign Direct Investment in Manufacturing Sector

For the linkage between the movements of US currency and FDI at individual sector-specific level, it can be seen that the estimated parameter for the variable ΔUSD_t is positively significant for FDI in textiles sector to Thailand. Nonetheless, the relation appears to be negative for FDI in metal and nonmetallic industry. Therefore, the effect of US Dollar movements is mixed for FDI in manufacturing sector. In other words, there is no clear-cut conclusion to explain the relationship between US Dollar movements and FDI in manufacturing industry.

Regarding the volatility of USD, the coefficients turn to be negative for FDI in food and sugar, and textiles industry, while FDI in petroleum products industry holds the opposite direction. For FDI in machinery and transportation equipment sector, the negative effect predominate the positive. As a result, most of FDI in manufacturing category are negatively influenced by the US Dollar volatility.

The negative relation can be described by the reason that the high degree of US Dollar volatility decreases the inflows of FDI in food and sugar, machinery and transportation equipment, and textiles industry to Thailand or it might plausibly interpret as the high degree of US Dollar volatility boosts the level of FDI inflows in the abovementioned sector to USA. This result is contrary to our prediction; nevertheless, it can be explained by the reason the study of Markusen (1995) found out that firms engage in FDI in order to avoid the exchange rate risk which is the cost of international trade.

As reported earlier, the direction of sectoral FDI responsiveness in manufacturing durables category to the movements of US currency and its volatility differs by sectors. Specifically, it is of interest to find out that the impact of the movements of USD and its volatility on FDI in both manufacturing durables and manufacturing nondurables is corresponding with the data gathered from the Board of Investment presented in Figure 5 indicated that US investors largely flows their funds to invest in manufacturing category such as metal products and machine, chemicals and paper, as well as electric and electronic products. Consequently, it is unquestionable to see that FDI in manufacturing category are likely to sensitive to the movements of US Dollar as well as its variation.

5.3.2 The Effect of US Dollar Movements and US Dollar Volatility on Foreign Direct Investment in Nonmanufacturing Sector

Apparently, the coefficient on ΔUSD_t is negatively significant in investment sector indicating that US Dollar depreciation with respect to Thai Baht decreases the inflows of FDI in investment industry.

Concerning the USD volatility, the estimated coefficient on σ_{t-6}^{USD} turns to be positive in service industry. As a consequence, it can be interpreted that the inflows of FDI in service sector to Thailand are likely to rise under the environment of high degree of US Dollar volatility.

These significant effects of US Dollar movements and US Dollar volatility on FDI in investment and service industry which all are categorized as nonmanufacturing are contrary to the hypothesis stated that in general, nonmanufacturing firms' operation is mainly related with domestic market; therefore, the movements of USD as well as US currency volatility may not be influential in describing the inflows of FDI in nonmanufacturing industry.

However, these significant findings could be supported by the reason of different financial structure of each industry on the ground that in those aforementioned industries that are impacted by the US Dollar movements and USD volatility, there may be a high proportion of US investors relative to domestic investment. Therefore, the inflows of foreign investment in those sectors are affected when the value of US Dollar changes or volatiles over time.

5.3.3 Diagnostic Test

From Table 10, it is apparently seen that there is no presence of serial correlations and heteroskedasticity. Moreover, the moderate fraction of the variance of the dependent variable can be described by the independent variables. Nevertheless, non-normal distribution appears in most of residuals.

Table 10: Estimated Coefficients,

FDI_t^i	α	FDI_{t-1}^i	ΔUSD_t	ΔUSD_{t-6}	ΔUSD_{t-12}	MPI	r	σ_t^{USD}	σ_{t-6}^{USD}	σ_{t-12}^{USD}	R^2	JB	Q-$Stat$	Sq-$Residuals$
All industries	-0.0024	-0.6124***	-3.1179	1.2935	-2.1861	-0.0004	0.0063	0.4482	0.8291	1.2065	0.3901	36.6405***	9.1245	3.0421
	(0.0093)	(0.0876)	(2.0053)	(1.8344)	(1.9052)	(0.0006)	(0.0068)	(1.0353)	(1.1010)	(1.1845)				
Manufacturing	-0.0042	-0.1472	0.0715	-0.1014	-1.2615**	0.001	0.0041	0.2117	-0.2439	0.5583	0.3341	12.234***	2.1454	14.386**
	(0.0030)	(0.1024)	(0.6410)	(0.5823)	(0.5967)	(0.0002)	(0.0021)	(0.3317)	(0.3532)	(0.3766)				
Durables Goods	0.0008	-0.1135	-0.1405	-0.0141	-0.7592	0.0004**	0.0043**	-0.3127	0.0757	0.2491	0.2211	8.1723**	15.687**	7.3715
	(0.0022)	(0.1055)	(0.4764)	(0.4263)	(0.4374)	(0.0002)	(0.0016)	(0.2428)	(0.2578)	(0.2798)				
- Construction Materials	0.0001	-0.0313	-0.0165	0.0077	-0.0295	-0.0003	0.0001	-0.0023	-0.0021	-0.0245	0.2879	15135.96***	3.2835	0.0688
	(0.0001)	(0.1107)	(0.0346)	(0.0314)	(0.0322)	(0.0001)	(0.0001)	(0.0178)	(0.0190)	(0.0210)				
- Machinery and	-0.0002	-0.1277	0.0031	0.1056	-0.264	0.0003**	0.0008	-0.5860***	0.0798	0.6027**	0.2604	74.3373***	10.7630	12.7610
Transportation Equipment	(0.0017)	(0.1015)	(0.3738)	(0.3388)	(0.3467)	(0.0001)	(0.0012)	(0.1939)	(0.2045)	(0.2194)				
- Electrical Appliances	-0.0003	0.2902***	-0.0941	0.1571	-0.0977	0.0002***	0.0008	0.0886	-0.08	-0.1758	0.2238	1.0924	14.696**	1.2569
	(0.0011)	(0.1107)	(0.2574)	(0.2292)	(0.2356)	(0.0001)	(0.0008)	(0.1345)	(0.1389)	(0.1538)				
- Metal and Nonmetallic	0.0012	0.0209	0.152	-0.2911**	-0.2924	-0.0001	0.0016***	0.0449	0.1159	0.0188	0.2889	31.755***	3.2188	0.7939
	(0.0007)	(0.0992)	(0.1508)	(0.1377)	(0.1403)	(0.0005)	(0.0005)	(0.0785)	(0.0829)	(0.0895)				

This table reports the result of exposure coefficients regressed by the following two equations:

$$FDI_t = \propto_0 + \propto_1 FDI_{t-1} + \propto_2 \Delta USD_t + \propto_3 \Delta USD_{t-6} + \propto_4 \Delta USD_{t-12} + \propto_5 MPI_t + \propto_6 r_t + \propto_7 \sigma_t^{USD} + \propto_8 \sigma_{t-6}^{USD} + \propto_9 \sigma_{t-12}^{USD} + \varepsilon_t$$

where FDI_t is the overall FDI, FDI_{t-1} denotes lagged one month overall FDI. The optimal lag is specified based on Akaike Information Criterion (AIC), ΔUSD_t represents the log return of US Dollar, σ_t^{USD} is the measure of US Dollar volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔUSD_{t-6}, ΔUSD_{t-12} , σ_{t-6}^{USD}, and σ_{t-12}^{USD} is defined as lagged six month US Dollar, lagged twelve month US Dollar, lagged six month volatility of US Dollar, and lagged twelve month volatility of US Dollar, respectively. ε_t is the residual term.

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta USD_t + \alpha_3^i \Delta USD_{t-6} + \alpha_4^i \Delta USD_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{USD} + \alpha_8^i \sigma_{t-6}^{USD} + \alpha_9^i \sigma_{t-12}^{USD} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC)

The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table10: Estimated Coefficients, α_i (continued)

FDI_t^i	α	FDI_{t-1}^i	ΔUSD_t	ΔUSD_{t-6}	ΔUSD_{t-12}	MPI	r	σ_t^{USD}	σ_{t-6}^{USD}	σ_{t-12}^{USD}	R^2	JB	Q-$Stat$	Sq-$Residuals$
Nondurables Goods	0.0043	-0.2923***	0.0833	-0.0305	-0.071	-0.0002	0.0009	-0.0644	0.0141	0.1731	0.3004	76.5543***	12.568**	11.828**
	(0.0016)	(0.1077)	(0.3485)	(0.3204)	(0.3247)	(0.0001)	(0.0011)	(0.1812)	(0.1912)	(0.2060)				
- Food and Sugar	0.0008	-0.1238	0.1237	0.0947	-0.0283	-0.0003	0.0004	-0.2840***	0.1677	0.1137	0.3084	255.8671***	3.0984	1.4972
	(0.0009)	(0.1125)	(0.2075)	(0.1894)	(0.1950)	(0.0003)	(0.0007)	(0.1122)	(0.1141)	(0.1236)				
- Textiles	0.0002	0.061	0.0847***	-0.0097	-0.0234	-0.0003	0.0001**	-0.0357***	-0.0051	0.0104	0.3074	71.835***	3.3868	1.2619
	(0.0001)	(0.1072)	(0.0284)	(0.0258)	(0.0265)	(0.0009)	(0.0001)	(0.0147)	(0.0156)	(0.0169)				
- Chemicals	0.0027	0.0394	0.0815	0.1453	-0.02	-0.0002	0.0004	-0.0216	-0.1886	-0.017	0.2606	6403.996***	4.8630	0.6929
	(0.0011)	(0.1112)	(0.2489)	(0.2250)	(0.2314)	(0.0007)	(0.0008)	(0.1276)	(0.1372)	(0.1459)				
- Petroleum products	-0.0011	-0.4115***	-0.0343	0.2977	-0.3563	-0.0001	0.0018***	0.3153***	0.3189***	0.0974	0.2955	1175.304***	5.1430	1.8098
	(0.0010)	(0.0933)	(0.2254)	(0.2031)	(0.2081)	(0.0001)	(0.0007)	(0.1159)	(0.1234)	(0.1314)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta USD_t + \alpha_3^i \Delta USD_{t-6} + \alpha_4^i \Delta USD_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{USD} + \alpha_8^i \sigma_{t-6}^{USD} + \alpha_9^i \sigma_{t-12}^{USD} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), ΔUSD_t represents the log return of US Dollar, σ_t^{USD} is the measure of US Dollar volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔUSD_{t-6}, ΔUSD_{t-12} , σ_{t-6}^{USD}, and σ_{t-12}^{USD} is defined as lagged six month US Dollar, lagged twelve month US Dollar, lagged six month volatility of US Dollar, and lagged twelve month volatility of US Dollar, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

Table10: Estimated Coefficients, α_i (continued)

FDI_t^i	α	FDI_{t-1}^i	ΔUSD_t	ΔUSD_{t-6}	ΔUSD_{t-12}	MPI	r	σ_t^{USD}	σ_{t-6}^{USD}	σ_{t-12}^{USD}	R^2	JB	Q-$Stat$	Sq-$Residuals$
Nonmanufacturing	-0.01	0.1617	-4.7524***	-0.9164	0.4186	0.0006	0.0065	1.9408**	0.9456	-0.6172	0.2995	73.5567***	5.3986	3.0827
	(0.0082)	(0.1006)	(1.7401)	(1.5784)	(1.6171)	(0.0005)	(0.0059)	(0.9056)	(0.9546)	(1.0216)				
- Financial	-0.0005	-0.3333***	0.0158	1.1285	1.0964	-0.0001	0.0013	0.555	-0.1808	0.158	0.2344	18.9114***	20.083**	9.2427
Institution	(0.0032)	(0.1001)	(0.6893)	(0.6258)	(0.6618)	(0.0002)	(0.0023)	(0.3525)	(0.3747)	(0.4026)				
- Trade	0.0045	-0.2311***	-0.5445	-0.1186	0.0851	-0.0004	-0.0002	-0.1313	0.5414	0.5718	0.2907	318.9466***	9.7499**	16.947***
	(0.0051)	(0.1066)	(1.1039)	(1.0232)	(1.0234)	(0.0003)	(0.0037)	(0.5681)	(0.6033)	(0.648)				
- Agriculture	-0.0002	-0.6155***	0.017	0.021	0.0084	0.0005	0.0001	-0.0029	0.0041	0.0061	0.3771	604.2592***	19.686***	5.8169
	(0.0009)	(0.0873)	(0.02)	(0.0181)	(0.0186)	(0.0006)	(0.0002)	(0.0103)	(0.011)	(0.0118)				
- Construction	0.0059	-0.0784	0.0023	0.0026	-0.0484	-0.0034	-0.0005**	-0.0569	-0.0036	0.0475	0.2125	4523.96***	3.5638	0.0953
	(0.0005)	(0.1112)	(0.073)	(0.0657)	(0.0673)	(0.0002)	(0.0002)	(0.0386)	(0.0397)	(0.0427)				
- Mining and	-0.0006	0.145	-0.2524	-0.0886	-0.0737	-0.0002	-0.0001	0.2638	-0.0149	0.1808	0.2219	4.2297	8.1437	1.7072
Quarrying	(0.0012)	(0.1132)	(0.2638)	(0.2399)	(0.248)	(0.0001)	(0.0009)	(0.141)	(0.1453)	(0.1579)				
- Investment	-0.0061	-0.2245***	-3.224***	-0.0263	0.257	0.0005***	0.0055**	0.2507	0.3615	-0.5942	0.2017	1577.407***	12.8850	8.9421
	(0.0042)	(0.0993)	(0.9044)	(0.8152)	(0.8361)	(0.0003)	(0.003)	(0.4625)	(0.4926)	(0.5282)				
- Services	0.0013	-0.074	-0.1744	-0.65	-0.1857	-0.0001	0.001	0.2443	0.4929**	-0.423	0.2039	76.8572***	1.8751	0.2012
	(0.0022)	(0.1046)	(0.4801)	(0.4375)	(0.4458)	(0.0001)	(0.0016)	(0.2472)	(0.2635)	(0.2817)				
- Real estates	-0.0055	0.2178**	0.0545	0.349	0.3562	0.0004**	-0.0018**	0.2016	-0.1014	0.1172	0.4165	37.1171***	5.0765	2.0438
	(0.0014)	(0.1071)	(0.2645)	(0.2456)	(0.2487)	(0.0001)	(0.0009)	(0.137)	(0.1471)	(0.1573)				

This table reports the result of exposure coefficients regressed by the following equation:

$$FDI_t^i = \alpha_0^i + \alpha_1^i FDI_{t-1}^i + \alpha_2^i \Delta USD_t + \alpha_3^i \Delta USD_{t-6} + \alpha_4^i \Delta USD_{t-12} + \alpha_5^i MPI_t + \alpha_6^i r_t + \alpha_7^i \sigma_t^{USD} + \alpha_8^i \sigma_{t-6}^{USD} + \alpha_9^i \sigma_{t-12}^{USD} + \varepsilon_t$$

where FDI_t^i is FDI in sector i at time t, FDI_{t-1}^i denotes sectoral FDI in last one month that is selected by Akaike Information Criterion (AIC), ΔUSD_t represents the log return of US Dollar, σ_t^{USD} is the measure of US Dollar volatility, MPI_t is the real manufacturing production index, r_t is the cost of capital, ΔUSD_{t-6}, ΔUSD_{t-12}, σ_{t-6}^{USD}, and σ_{t-12}^{USD} is defined as lagged six month US Dollar, lagged twelve month US Dollar, lagged six month volatility of US Dollar, and lagged twelve month volatility of US Dollar, respectively. ε_t is the residual term. The standard deviations are given in the parentheses.

The Jarque-Bera Statistics is reported in order to test for normality. The Correlogram Q-Statistics and Correlogram Square-Residuals are used to test serial correlation and heteroskedasticity.

*** Significant at the 1% level, ** Significant at the 5% level

5.4 The Effect of Exchange Rate Movements and Exchange Rate Risk on Portfolio Investment at Firm-specific Level

In this section, I report the responsiveness of individual firm-specific international portfolio investment to exchange rate movements and exchange rate risk, as well as other crucial variables determining the flows of equity portfolio investment to Thailand. The output of estimating equation (15) from panel data is concluded in Table 11.

Table11: Estimated Coefficients, βi

Explanatory variables	$FORTRADE_{i,t}$	*t-statistics*
SIZEi,t	0.0038	-0.3132
MVBVi,t	-0.0001	(-0.5537)
RETi,t	0.0984	(2.2147**)
BETAi	34.5428	-1.948
ΔREERt	45.6103	(4.1922***)
ΔREERt-1	25.0292	(2.7994***)
ΔREERt-6	7.0522	-1.1718
σt	-7.0894	(-2.0328**)
σt-1	9.7183	-3.1625
σt-6	5.4877	-1.3082
R^2	0.31063	

This table reports the result of exposure coefficients regressed by the following equation:

$$FORTRADE_{i,t}=\alpha_i+\beta_1 SIZE_{i,t}+\beta_2 MVBV_{i,t}+\beta_3 RET_{i,t}+\beta_4 BETA_i+\beta_5 \Delta REER_t+\beta_6 \Delta REER_{t-1}+\beta_7 \Delta REER_{t-6}+\beta_8 \sigma_t+\beta_9 \sigma_{t-1}+\beta_{10} \sigma_{t-6}+\varepsilon_{i,t}$$

where $FORTRADE_{i,t}$ is the net foreign trading computed by foreign purchase minus foreign sale. This dependent variable is used as a proxy of firm-specific portfolio investment flows. α_i indicates fixed effects in panel data method, $SIZE_{i,t}$ represents a size of firm i characteristics and years t, $MVBV_{i,t}$ is market-to-book ratio, $RET_{i,t}$ denotes stock returns, $BETA_{i,t}$ is CAPM beta of the stock, $\Delta REER_t$ denotes log return of real exchange rate, σ_t is the measure of real effective exchange rate volatility, $\Delta REER_{t-1}$, $\Delta REER_{t-6}$, σ_{t-1} , and σ_{t-6} represent lagged one month real effective exchange rate, lagged six month real effective exchange rate, lagged one month volatility of exchange rate, and lagged six month volatility of exchange rate, respectively, $\varepsilon_{i,t}$ is an error term. The t-value based on heteroskedasticity corrected standard errors according to White (1980) are reported in parentheses.

*** Coefficient is significant at the 1% level, ** Coefficient is significant at the 5% level

By analyzing the estimated results, this section provides empirical findings on the linkage between firm-specific foreign equity trading, exchange rate movements and exchange rate risk.

Referring to Table 11, it can be clearly seen that coefficient on $RET_{i,t}$ is positively significant indicating that stock return has a positively significant effect on foreign participation. This can then be interpreted that the higher the return on financial asset is, the higher the inflows of portfolio investment to Thailand. This result is as earlier expected and

in line with the work of Eva and Anders (2005) stated that stock return could be used to classify whether international investors are momentum or contrarian. The momentum investors are likely to invest in those well-performed securities simply because they believe that securities that historically outperform the market are highly possible to show the good performance in the subsequent period. As a result, momentum investors tend to invest in securities that previously generate high returns. In this case, a rise in stock return persuades international investors to move their fund flows into Thailand, this contributes to conclude that foreign portfolio investor are typed as momentum investor. Further, the rate of return from holding the financial securities significantly causes the differentiating investment decision of international investors.

For the movement of exchange rate, the estimated coefficient of $\Delta REER_t$ and $\Delta REER_{t-1}$ are positively significant. This means that appreciation of Thai Baht with respect to other currencies in the basket increases the inflows of portfolio investment at firm-specific level. This result could be described by the reason of momentum investors in the sense that in case that foreign investor allocate their funds to portfolio investment and Thai Baht subsequently appreciates, the profit gained from international diversification would increase when they convert their profit from Thai Baht currency into their home country currency. Because momentum investors are likely to invest based on historical performance; therefore, they tend to flow their funds to Thailand when Thai Baht appreciates.

Regarding the exchange rate risk, the parameter of σ_t is negatively significant. This link can be described on the ground that exchange rate risk is one of the important sources of nondiversifiable risk made foreign investment riskier compared with domestic investment, according to Carrieri and Majerbi (2006). Therefore, exchange rate risk is counted as another uncertain climate for foreign investors by making profitability and cost of investment activities harder to predict, referring to Servén (1999); as a consequence, the lower inflows of portfolio investment can be seen when exchange rate risk rises.

5.5 The Effect of Japanese Yen Movements and Japanese Yen Volatility on Portfolio Investment at Firm-specific Level

The reported results from estimating the linkage between the Japanese Yen movements, the Japanese Yen volatility, and portfolio investment by firms are shown below:

Table12: Estimated Coefficients, βi

Explanatory variables	$FORTRADE_{i,t}$	*t-statistics*
$SIZE_{i,t}$	0.0042	-0.3381
$MVBV_{i,t}$	-0.0001	(-0.5914)
$RET_{i,t}$	0.094	(2.2301**)
$BETA_i$	21.8217	-1.2061
ΔJPY_t	12.9217	-1.567
ΔJPY_{t-1}	10.8856	-1.5672
ΔJPY_{t-6}	15.4664	(2.3761**)
σ_t^{JPY}	-5.805	(-1.2026)
σ_{t-1}^{JPY}	5.9476	-1.5664
σ_{t-6}^{JPY}	4.938	-1.7004
R^2	0.308122	

This table reports the result of exposure coefficients regressed by the following equation:

$$FORTRADE_{i,t}=\alpha_i+\beta_1 SIZE_{i,t}+\beta_2 MVBV_{i,t}+\beta_3 RET_{i,t}+\beta_4 BETA_i+\beta_5\Delta JPY_t+\beta_6\Delta JPY_{t-1}+\beta_7\Delta JPY_{t-6}+\beta_8\sigma_t^{JPY}+\beta_9\sigma_{t-1}^{JPY}+\beta_{10}\sigma_{t-6}^{JPY}+\varepsilon_{i,t}$$

where $FORTRADE_{i,t}$ is the net foreign trading computed by foreign purchase minus foreign sale. This dependent variable is used as a proxy of firm-specific portfolio investment flows. α_i indicates fixed effects in panel data method, $SIZE_{i,t}$ represents a size of firm i characteristics and years t, $MVBV_{i,t}$ is market-to-book ratio, $RET_{i,t}$ denotes stock returns, $BETA_{i,t}$ is CAPM beta of the stock, ΔJPY_t denotes log return of the Japanese Yen, σ_t^{JPY} is the measure of Japanese Yen volatility, ΔJPY_{t-1}, ΔJPY_{t-6}, σ_{t-1}^{JPY}, and σ_{t-6}^{JPY} represent lagged one month the Japanese Yen, lagged six month the Japanese Yen, lagged one month volatility of the Japanese Yen, and lagged six month volatility of the Japanese Yen, respectively, $\varepsilon_{i,t}$ is an error term. The t-value based on heteroskedasticity corrected standard errors according to White (1980) are reported in parentheses.
*** Coefficient is significant at the 1% level, ** Coefficient is significant at the 5% level

According to Table 12, it is obviously seen that the parameter of $RET_{i,t}$ is positively significant. This noteworthy result leads to the conclusion associated with characteristics of investors in the sense that investment decision for international investors rely heavily on securities' return. In addition, from the findings, it can also be interpreted that Japanese investors are categorized as momentum investors making investment decision based on financial assets' return.

Besides, the exposure coefficient on ΔJPY_{t-6} is positively significant and could possibly be implied that an appreciation of Thai Baht against Japanese Yen raises the inflows of portfolio investment by firm into Thailand. This result is corresponding to the case of Real Effective Exchange Rate and our hypothesis.

5.6 The Effect of US Dollar Movements and US Dollar Volatility on Portfolio Investment at Firm-specific Level

The concluding results from estimating the relationship between the US Dollar movements, the US Dollar volatility, and portfolio investment by firms are presented below:

Table13: Estimated Coefficients, βi

Explanatory variables	$FORTRADE_{i,t}$	*t-statistics*
$SIZE_{i,t}$	0.0043	-0.3446
$MVBV_{i,t}$	-0.0001	(-0.5509)
$RET_{i,t}$	0.0895	(2.1705**)
$BETA_i$	24.5986	-1.4184
ΔUSD_t	34.3488	(2.8159***)
ΔUSD_{t-1}	3.9434	-0.4149
ΔUSD_{t-6}	-2.9671	(-0.4251)
σ_t^{USD}	-1.6908	(-0.2465)
σ_{t-1}^{USD}	2.3069	-0.355
σ_{t-6}^{USD}	1.5617	-0.251
R^2	0.308419	

This table reports the result of exposure coefficients regressed by the following equation:

$$FORTRADE_{i,t} = \alpha_i + \beta_1 SIZE_{i,t} + \beta_2 MVBV_{i,t} + \beta_3 RET_{i,t} + \beta_4 BETA_i + \beta_5 \Delta USD_t + \beta_6 \Delta USD_{t-1} + \beta_7 \Delta USD_{t-6} + \beta_8 \sigma_t^{USD} + \beta_9 \sigma_{t-1}^{USD} + \beta_{10} \sigma_{t-6}^{USD} + \varepsilon_{i,t}$$

where $FORTRADE_{i,t}$ is the net foreign trading computed by foreign purchase minus foreign sale. This dependent variable is used as a proxy of firm-specific portfolio investment flows. α_i indicates fixed effects in panel data method, $SIZE_{i,t}$ represents a size of firm i characteristics and years t, $MVBV_{i,t}$ is market-to-book ratio, $RET_{i,t}$ denotes stock returns, $BETA_{i,t}$ is CAPM beta of the stock, ΔUSD_t denotes log return of the US Dollar, σ_t^{USD} is the measure of US Dollar volatility, ΔUSD_{t-1} , ΔUSD_{t-6}, σ_{t-1}^{USD} , and σ_{t-6}^{USD} represent lagged one month the US Dollar, lagged six month the US Dollar, lagged one month volatility of the US Dollar, and lagged six month volatility of the US Dollar, respectively, $\varepsilon_{i,t}$ is an error term. The t-value based on heteroskedasticity corrected standard errors according to White (1980) are reported in parentheses.
*** Coefficient is significant at the 1% level, ** Coefficient is significant at the 5% level

From Table 13, it is shown that the parameter of $RET_{i,t}$ is positively significant; therefore, it can be summarized that financial assets' return is a significant determinant of international firm-specific portfolio investment. The linkage of these two variables turns out to be positive implying that the higher the return on financial assets is, the larger the proportion of foreign holdings. Besides, it indicates that the US investors are classified as momentum investors deciding their portfolio investment decision based on previous stocks' return.

Moreover, the coefficient on ΔUSD_t is positively significant. This result implies that international investors are interested in diversifying their portfolios to other countries instead of Thailand when there is a tendency of depreciation of Thai Baht with respect to US currency. This result appears to be corresponding to the findings from Real Effective Exchange Rate as well as the case of Japanese Yen.

CHAPTER VI

CONCLUSIONS

The goal of this study is to determine whether exchange rate movements and exchange rate risk affect the overall flows of FDI, FDI at industry-specific level, as well as portfolio equity inflows at firm-level to Thailand.

By using a time-series method based on monthly data spans from 2001 to 2009, the empirical result shows that the overall FDI inflows is significantly determined by exchange rate movements. Aside from this, FDI in each sector fluctuates by different degrees to exchange rate movements and exchange rate risk. This difference arises from a variety of differences in the operation of each industry. Apart from analyzing the effect based on the real effective exchange rate, this paper also introduces the bilateral exchange rates comprised the Japanese Yen with respect to Thai Baht, and the US Dollar relative to Thai Baht into the analyzing process.

Of the sixteen sectors, four are classified as being manufacturing durables, four are typed as being manufacturing nondurables, and the rest are nonmanufacturing. The notable result shows that the movement in exchange rate plays an important role in explaining the overall flows of FDI, FDI in machinery and transportation equipment, chemicals, textiles, finance institutions, and investment industries. The exchange rate risk has a statistically significant influence on FDI in machinery and transportation equipment, chemicals, food and sugar, finance institutions, mining and quarry, petroleum products, and services sectors.

As for the impact of Japanese Yen movements, it has a significant consequence on the overall flows of FDI, FDI in machinery and transportation equipment, and FDI in services sector in nonmanufacturing category. The Japanese Yen volatility is significantly associated with FDI in machinery and transportation equipment, as well as metal and nonmetallic industries in manufacturing durables category. Thus, it might presumably summarize that the Japanese Yen movements and its volatility are the key determinants of FDI in manufacturing durables category.

FDI flows in metal and nonmetallic, investment and textiles sectors are significantly sensitive to the movements of US currency. The US Dollar volatility is significantly related with the arrival of FDI in machinery and transportation equipment, petrochemicals, services, food and sugar, and textiles industries.

Another section of this paper examines the impact of exchange rate movement and exchange rate risk on international portfolio flows at firm-specific level to Thailand. By using panel data techniques based on the monthly basis during the year 2005 to 2009, this paper investigates that foreign equity investment by firms are indifferently react to exchange rate movements and exchange rate risk. The inflows of foreign portfolio investment are driven partly by both exchange rate movements and exchange rate risk. Regarding the exchange rate movements, an increase in the value of Thai Baht relative to others in the basket significantly brings about the higher proportion of foreign equity holdings at individual firm-specific level in Thailand. Concerning the exchange rate risk, it is found out that the relation between the exchange rate risk and international investors' participation are negative indicating that high exchange rate risk lowers the firm-specific foreign portfolio investment. Also the securities' return is another powerful determinant of international firm-specific portfolio flows to Thailand.

Similar to the previous section, this paper also explores in greater details the effect of the movements in Japanese Yen, US Dollar and their volatilities on foreign participation in each individual stock. The noteworthy findings report that both of the Japanese Yen and the US Dollar movements significantly determine international portfolio investors' decision.

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BIOGRAPHY

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