

Effect of Exchange Rate, Exchange Rate Volatility, and Stock
Market Return on Foreign Direct Investment

Miss Sansanee Vanapruk



An Independent Study Submitted in Partial Fulfillment of the
Requirements
for the Degree of Master of Arts in Business and Managerial Economics
Field of Study of Business and Managerial Economics
FACULTY OF ECONOMICS
Chulalongkorn University
Academic Year 2021
Copyright of Chulalongkorn University

-



สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์ธุรกิจและการจัดการ สาขาวิชาเศรษฐศาสตร์ธุรกิจและการจัดการ
คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2564
ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

Independent Study Title Effect of Exchange Rate, Exchange Rate
Volatility, and Stock Market Return on Foreign
Direct Investment
By Miss Sansanee Vanapruk
Field of Study Business and Managerial Economics
Thesis Advisor Assistant Professor NIPIT WONGPUNYA,
Ph.D.

Accepted by the FACULTY OF ECONOMICS, Chulalongkorn
University in Partial Fulfillment of the Requirement for the Master of
Arts

INDEPENDENT STUDY COMMITTEE

..... Chairman
(Assistant Professor SAN SAMPATTAVANIJA,
Ph.D.)

..... Advisor
(Assistant Professor NIPIT WONGPUNYA,
Ph.D.)

..... Examiner
(PANUTAT SATCHACHAI, Ph.D.)

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

ศันสนีย์ วรรณพฤกษ์ : . (Effect of Exchange Rate, Exchange Rate Volatility, and Stock Market Return on Foreign Direct Investment) อ.ที่ปรึกษาหลัก : ผศ. ดร.นิพิฐ วงศ์ปัญญา

-



สาขาวิชา	เศรษฐศาสตร์ธุรกิจและการจัดการ	ลายมือชื่อนิติต
ปีการศึกษา	2564	ลายมือชื่อ อ.ที่ปรึกษาหลัก

6384062429 : MAJOR BUSINESS AND MANAGERIAL ECONOMICS

KEYWORD FDI, Exchange rate, volatility, SET index

RD:

Sansanee Vanapruk : Effect of Exchange Rate, Exchange Rate Volatility, and Stock Market Return on Foreign Direct Investment. Advisor: Asst. Prof. NIPIT WONGPUNYA, Ph.D.

This empirical research examines the relationship between exchange rate, exchange rate volatility, and also investigates the stock market return factors on the foreign direct investment flows in Thailand. This research uses the quarterly data from 1Q2005 to 4Q2020 period. It finds that there is the evidence of significantly positive relationship of exchange rate on foreign direct investment while exchange rate volatility has the significantly negative relationship on foreign direct investment. There is also the relationship but not significant of high performance of stock market return on attracting foreign direct investment flows. Moreover, this paper documents that the former foreign direct investment itself and real exchange rate influence the investor's FDI decision in current period as well. The vector autoregression model (VAR) is used for forecasting. The finding indicates that 1-quarter lagged of FDI itself is positively significant affecting the current FDI flows.



Field of Study:	Business and Managerial Economics	Student's Signature
Academic Year:	2021
		Advisor's Signature
	

ACKNOWLEDGEMENTS

I would like to give my sincere gratitude to Assistant Professor Nipit Wongpanya, Ph.D. who helps consulting me throughout period of this paper proceeding period. I am grateful to my best friend Miss Thanatporn Santawat who went to the same high school and also studied Engineering together at Chulalongkorn University in helping adding valuable and insightful suggestion. I also thank my MABE classmates in cheering me up during this whole tough period.

Sansanee Vanapruk



TABLE OF CONTENTS

	Page
ABSTRACT (THAI)	iii
ABSTRACT (ENGLISH).....	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
1. Introduction.....	1
1.1 Background.....	1
1.2 Objective of the Study	5
1.3 Hypothesis Development.....	6
2. Literature Review.....	8
2.1 Exchange Rate and Foreign Direct Investment	8
2.2 Exchange Rate Volatility and Foreign Direct Investment.....	9
2.3 Stock Market Return and Foreign Direct Investment.....	11
2.4 Foreign Direct Investment in the past period and Foreign Direct Investment in the present or current period.....	12
3. Data.....	13
3.1 Data.....	13
3.2 Descriptive Statistics and Correlation	14
3.3 Stationary of Data	16
3.4 Optimal Lag Determination	16
4. Methodology	17
4.1 Benchmark Model	17
4.2 Additional Control Variable	19
4.3 Some Extension	19
5. Result Analysis	20

5.1 Exchange Rate and Exchange Rate Volatility on Foreign Direct Investment Flows	20
5.2 Exchange Rate, Exchange Rate Volatility, and Stock Exchange Market Performance on Foreign Direct Investment Flows.....	21
5.3 Former Period of Foreign Direct Investment and Real Exchange Rate on Current Foreign Direct Investment Flows	23
6. Conclusion	25
APPENDIX.....	27
REFERENCES	31
VITA.....	34



LIST OF TABLES

	Page
Table 1: Foreign direct investment net flows to Thailand, 2000-2020 (Bn of dollars) .3	
Table 2: List of Variables	13
Table 3: Summary Statistics	15
Table 4: Correlation Matrix	15
Table 5: Results of ADF t-statistics	16
Table 6: Results of Optimal Lag Selection	17
Table 7: Regression results	22
Table 8: Vector Autoregression (VAR) Results	23
Table 9: Full regression results #1 (Extend from Table 7 model 1)	27
Table 10: Full regression results #2 (Extend from Table 7 model 2)	28
Table 11: Full lnFDIGDP regression results #3 (Extend from Table 8).....	29
Table 12: Full RER regression results #4 (Extend from Table 8)	30

LIST OF FIGURES

	Page
Figure 1: Global Foreign direct investment inflows, 2000-2020.....	2
Figure 2: Global FDI inflows by continent and Asia share of wallet, 2000-2020 (Bn of dollars).....	2
Figure 3: Impulse response function of the VAR “lnFDIGDP-RER.....	24



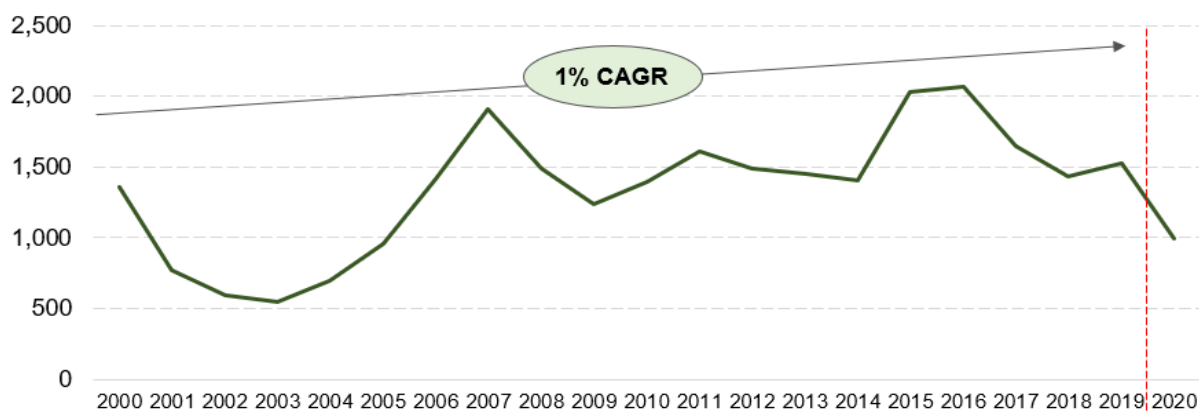
1. Introduction

1.1 Background

Foreign direct investment or FDI is an international flow of capital that is flew from a parent company or a multinational organization with control by the oversea affiliates. According to Stephen Hymers's theory in 1960s, the reason behind foreign direct investment were explained by trade theory on neoclassical economics that the difference in the costs of production of goods between two countries cause the investment flows from high-cost production country to low-cost production country. Later, he proposed three additional assumptions of reason behind the FDI flows. Firstly, the foreign firm domestic investment in its country could be exhausted (firm-specific advantages) and need to exploit the opportunity overseas. Secondly, some conflict might occur if foreign firm which is already operating in its country wants to expand the business in the current market (removal of conflict). The last reason is the internationalization strategy to mitigate or diversifying the risk on investing in one country (asset allocation).

By 2019, the recorded global foreign direct investment of USD 1,530 billion with average annual growth rate of 1.0 percent over 20-year period (2000-2019) However, the overall flows have declined 35 percent year-on-year in 2020 due to Covid-19 situation. This is the lowest level of FDI since year 2005 and 20 percent lower than global financial crisis level in 2005.

Figure 1: Global Foreign direct investment inflows, 2000-2020

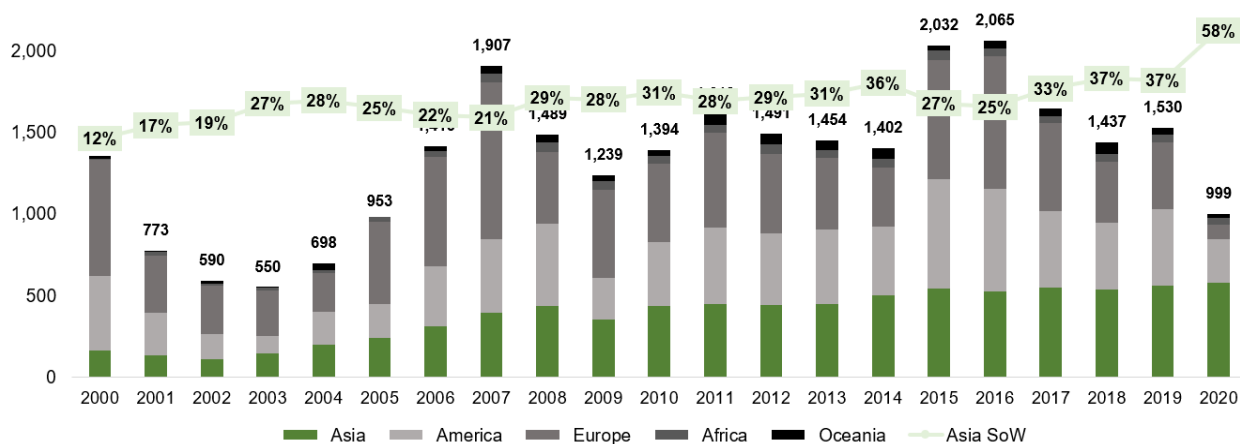


Source: UNCTAD

As global foreign direct investment grows, Asia region's total FDI inflows has continued rising with average CAGR of 7 percent from 2000 to 2019 period. Its share of wallet in inward FDI flows has also significantly plummeted from 12 percent of global FDI on 2000 to 37 percent on 2019. In 2020, the contribution proportion skyrocket to 58% of total FDI. Companies in developed or industrial countries like the United State or European countries are still the primary source of FDI flows.

FIGURE 2

Figure 2: Global FDI inflows by continent and Asia share of wallet, 2000-2020 (Bn of dollars)



Thailand had a well-recorded in attracting foreign direct investment, the number had grown from USD 3 billion in 2000 to USD 13 billion in 2018, 9 percent contribution to total South-eastern Asia region. However, the FDI inflows to the country has continually declined during these periods of time from investor shifting their investment decision to other CLMV countries- Cambodia, Laos PDR, Myanmar, and Vietnam due to its lower cost of production and increasing in investment welcoming. This also reflects in decrease in share of wallet percentage in foreign direct investment flows to Asean as well.

Table 1: Foreign direct investment net flows to Thailand, 2000-2020 (Bn of dollars)

	00	01	02	03	04	05	06	07	08	09	10
Thailand FDI	3.4	5.1	3.3	5.2	5.9	8.2	8.9	8.6	8.6	6.4	14.7
% Share of Wallet in Asean	15%	23%	21%	17%	15%	19%	14%	11%	17%	15%	13%
	11	12	13	14	15	16	17	18	19	20	
Thailand FDI	2.5	12.9	15.9	5.0	8.9	3.5	8.3	13.2	4.8	-4.8	
% Share of Wallet in Asean	3%	11%	13%	4%	8%	3%	5%	9%	3%	-4%	

Source: World Bank

According to Schmidt and Broll (2008) FDI allows for a more competent of resource allocation for the firm that invests. The target country, benefits from knowledge transfers which incite competition and increased local country's productivity. Previous researches suggest that

behavior of FX rate is potentially one of the influential factors of foreign direct investment flows.

Exchange rate depreciation or currency depreciation is a fall in the value of a currency in terms of its exchange rate against other currencies which could be from many reasons such as economics issue, interest rate differential, lack of political stability, and etc. When the target country's currency depreciates, it has potentially to attract the foreign direct investment due to this following reason. The value of the value of foreign firm currency increases relative to target country's currency. It reduces the associated costs e.g., employee wage, production cost, and cost of funds for foreign firm.

Exchange rate volatility is also one of the reasons that affect the FDI flows. Exchange rate volatility represents the degree of currency which fluctuates during the period time. The larger the proportion of a variable changes means the more volatile it is. Volatile in currency make investment decisions more difficult since higher uncertainty increases exchange rate risk which could affect the future profit of the investor firm. These two effects of currency movement potentially influence FDI decisions.

Despite of the effect of FX rate and FX rate instability on foreign direct investment, previous researches also suggested that stock market performance is one of the factors that influence FDI decisions as well. Return on stock market is the difference of wealth measured on the end of period versus initial investment amount on particular stock. It is usually calculated by return on stock market index or stock market index growth comparing to previous period which is the reflection of money made or lost during in investment period. According to Wu et al. (2016), positive stock

market return is directly affected the domestic country economic development and foreign interest. The positive return encourages foreign direct investment in several ways. Firstly, the stock market well performance can reflect the high productivity in domestic country.

Since there are evidences of benefit on foreign direct investment which will be further discussed in Literature review part. FDI flows not only bring the money flows but also brings tremendous benefits to recipient countries. FDI transfers not only financial resources, but also technology and managerial know-how from foreign countries. Therefore, this empirical research will explore on how exchange rate and exchange rate volatility affect foreign direct investment via extending majority of previous studies by incorporating the stock market return performance as well on foreign direct investment.

1.2 Objective of the Study

There are two main purposes of this empirical research to investigate.

1) This empirical research plans to examine the association of real exchange rate and real exchange rate volatility on the overall FDI to Thailand.

2) This paper aims to inspect other factor which might affect the foreign direct investment. In this paper, the stock market return or SET index return performance is taken into consideration.

1.3 Hypothesis Development

There are five main hypotheses of this empirical research.

Hypothesis 1 is to study the relationship of exchange rate on foreign direct investment net inflows in Thailand. It is expected to have the positive relationship between real exchange rate and FDI.

According to Froot and Stein (1991), the depreciation of the FX rate of the investor's home country is expected to attract the flow of FDI due to the two motives in the following. First of all, the FX rate depreciation of the target country helps reducing production costs in the domestic country which is lucrative for foreign countries searching for efficient in production. Second, the domestic exchange rate depreciation lessens the asset value in the domestic country.

Hypothesis 2 is to determine the relationship of exchange rate volatility on foreign direct investment in Thailand. It is expected to have the negative relationship between exchange rate volatility and FDI.

Kiyota and Urata (2004) suggested that the higher magnitude amount of exchange rate instability is forecasted to push down the net flows of FDI due to following reason. Uncertainty of exchange rate is unlike the investment in particular portfolio since it causes the sunk costs on unperforming investment. The tendency of FDI investors is expected to be risk-avoidance type who prefer less risk on FX rate changes.

Hypothesis 3 is to investigate the correlation of Thailand's stock market return or SET index return on foreign direct investment. It is expected to have positive relationship on SET index return on FDI.

Regarding to Soumaré and Tchana Tchana (2015) study, there is a link of foreign direct investment on stock market return. A relatively well-developed stock market helps attract foreign investors since the stock market is recognized as vitality of openness on the part of one's country and of a warm-welcome environment of stock market. This claim has more accuracy especially in emerging country that its stock market is more developed.

Hypothesis 4 is to explore on the relationship of real FX rate at some lags on foreign direct investment. It is expected to have relationship of real exchange rate with lag on FDI.

According to Aranyaratt (2011)'s research that she investigated on no-lagged (present period), 1-period lagged (1-month lagged), and 6-period lagged (6-month lagged). The coefficient of no-lagged real exchange rate is significant and more heavily influence the foreign direct investment comparing to 1-period lagged (also significant). While the coefficient of 6-period lagged is not significant.

Hypothesis 5 is to find the correlation of foreign direct investment itself at some lag on current foreign direct investment. It is expected to have relationship of foreign direct investment with lag on FDI.

A number of previous studies has shown the strong impact on foreign direct investment itself or foreign direct investment in the past period has the direct impact on FDI flows in the present period due to foreign direct investment flows in past period allows technology, capital, and human resource capabilities to investment target country. HUONG et al. (2021) had explained that present period FDI is weightily influenced by past period FDI.

The research is organized as follows. In this section, I provide the overall background and problem review altogether with Objective of the study and hypothesis development. Section 2 provides the literature review on related research area. Section 3 presents the data, descriptive statistics, correlation and stationery of data analysis. Section 4, reports the methodology or model used in this research. Section 5 reports the empirical result and analysis. Finally, I summarize and conclude in Section 6.

2. Literature Review

2.1 Exchange Rate and Foreign Direct Investment

Many previous investigations have endorsed the high correlated impacts of exchange rate on Foreign direct investment. Regarding to Kiyota and Urata (2004)'s investigation, the relationship between exchange rate and FDI in Japan by using annual data covering 1990 to 2000 periods. The authors examined the Japan's FDI on industry level and found that the depreciation in currency of target country can attract FDI. All of exchange rate coefficients in 11 distinguish industries had shown the significant negative impact on FDI.

Froot and Stein (1991) examined the connection of exchange rate and foreign direct investment from oversea countries to United States from year 1974 to 1987. The results showed that the depreciation of domestic currency can lead to higher FDI flow acquisitions. The research is done by breaking down FDI into 13 different industries which the FDI showed the statically strong negatively correlated with the value of dollar currency. A similar relationship is also confirmed by a number of studies. Klien and Rosengren (1994) found that U.S. inward foreign direct investment has significant relationship with the United States real exchange rate in 1979

to 1991. Takagi and Shi (2010) also founded the same relation of those in Japan. To sum up, these studies indicated that depreciation in currency of one country increases foreign direct investment flows into that country. (Nucci & Pozzolo, 2001) who researched on the Italian market also suggested that the home country currency depreciation stimulates the foreign investment decision.

While finding the effect of the real exchange rate on foreign direct investment, some researchers have showed the relationship of exchange rate with lag has direct impact on foreign direct investment. According to Aranyaratt (2011) who did the research on exchange rate risk or exchange rate instability impacts Thailand's foreign direct investment flow in overall country and industry level between 2001 to 2009 period (monthly data period). She found the significant responsive result of this. Plus, the paper also suggested the optimal lag of past 6-period lag.

2.2 Exchange Rate Volatility and Foreign Direct Investment

Despite of exchange rate effect on foreign direct investment, multiplicity of research study has indicated the evidence of relationship between exchange rate volatility on foreign direct investment flow. Empirical researches have shown the variety of relationship of exchange rate volatility and FDI inflows. The negative relationship result is confirmed by Cushman (1988) who studied the FDI flows from France, Germany, Japan, Canada and the U. K. to the U. S. in the period of 1963 to 1986 and Campa and Goldberg (1995).

Kiyota and Urata (2004) also analyzed the effect of exchange rate volatility on Japan's FDI on industry level and found the significant negative relationship between these two factors. The results showed that

the depreciation of the target country currency attracts FDI while large volatility in real exchange rates discourages foreign direct investment. Moreover, they deep dived their research topic into comparison of impact on host currency to home currency had more impact on investors than host currency to dollar currency. They also suggested that the exchange rate movements should be elastic but should not too sensitive in order to capture the foreign direct investment.

Aranyaratt (2011) analyzed the effect of FX risk on the overall FDI, FDI at industry level, and portfolio flows at specific company level to Thailand. The result shows the significant relationship of FDI flows and exchange rate on 7 specific industries- machine and transport equipment, chemical, food and sugar, financial institutions, mining and quarry, petroleum goods, and services industries. The association between exchange rate volatility and FDI flows is negative leading-indicator that great exchange rate volatility pushes down the firm-specific foreign portfolio flows to Thailand.

However, Schmidt and Broll (2008) who studied exchange rate uncertainty, exchange rate movements and expectations on foreign direct investment. The paper is focused on U.S. outward foreign direct investment by industry to top six FDI countries in the year 1984 to 2004. The results showed that U.S. FDI flows to non-manufacturing sector has positive relationship with increased in exchange rate volatility. While the relationship of manufacturing sector and FDI flows is significantly negative correlated.

Moreover, Phillips and Ahmadi-Esfahani (2008) discovered that there is a linkage between exchange rate volatility and foreign direct

investment which can be classified into 2 key rationales composing of risk aversion and production flexibility. According to production flexibility theory, the manufacturers are committed to two main factors- local and foreign capacity and employment decision after experiencing the exchange rate shocks. Therefore, the movements of exchange rate do not affect the level of FDI flows. On the other hand, risk aversion theory approach explains two main reasons of linkage between FDI flows and exchange rate volatility. Firstly, oversea cross- border investments would be partly motivated by changeability of exchange rate that foreign direct investment moves from the countries with high level of currency risk into the countries which provides higher stability in exchange rate movement. This claim is also supported by Foad (2005) who suggested that investors seek a certain stream of expected return on investment. Secondly, exchange rate volatility could affect the investment decision of investors due to potential profit and loss from the investment. Overall, the impact of the relationship of these two factors does not have the clear-cut conclusion.

2.3 Stock Market Return and Foreign Direct Investment

To extend from majority of previous studies, several researches suggest that stock market return performance is one factor on capturing foreign direct investment flows. Omorokunwa (2018) evaluated the effect of foreign investment on the performance of stock market in Nigeria. The study found that better stock market performance can help boosting foreign capital inflow.

According to De Santis and Ehling (2007), the result indicated that the stock market exercise is considered to be the most crucial factor of FDI flows and portfolio transactions. FDI flows are triggered by producing signals due to stock market performance movements which are important

for deciding in corporate investment. Adam and Tweneboah (2008)'s study on Ghana also suggested that there is an indirect but strong positive correlation between stock market performance and foreign direct investment.

Rajapakse (2018) researched on short-term and long-term relationships impact of stock market and foreign direct investment in the developing country- Sri Lanka. The findings suggested that there is directional correlation of stock exchange market return to FDI. Therefore, policy makers must target on developing the better performance of stock market for an incremental foreign direct investment flow to one's country.

Moreover, other researches such as Tsaourai (2014), Further, Kalim and Shahbaz (2009), and etc. mentioned on the financial markets especially stock market of developing countries had shown the increasing trend of good performance and well-management stock market is more likely to capture the FDI flows during the last two decades.

2.4 Foreign Direct Investment in the past period and Foreign Direct Investment in the present or current period

Given the complex relationship of other mentioned factors on FDI flows, some researchers believe that there is a relationship of former FDI to current FDI as well. HUONG et al. (2021) empirical study has researched on the relationship of quarterly FDI flows to Vietnam and trade openness from 2005 to 2019. The results are derived by vector autoregression model (VAR) which have shown that trade openness has relationship on FDI flows. Apart from that, the research has also shown the significant relationship of FDI in former period itself with 2-period optimal lag (period is measured in quarterly basis) is accounted for 87 percent of

the current period FDI flows especially in high technology industry sector. This research result is also supported by evidence from previous researches such as Head and Ries (1996) which insists on relationship of former FDI and supplier quantity on current FDI by company level. Cheng and Kwan (2000) found the positive relationship of FDI in previous period in China to present period.

3. Data

3.1 Data

This part contains explanation and source of data used in the research and descriptive statistics of the data. Due to limitation of Thailand data's availability, this research provides the quarterly data between the period of 2005 to 2020.

Table 2: List of Variables

Variable	Unit	Source
Foreign Direct Investment	Bt mn	Bank of Thailand
GDP	Bt mn	Bank of Thailand
Real Exchange Rate:		
Nominal Exchange Rate	Bt/ U.S. Dollar	Bank of Thailand
Consumer Price Index of Thailand (CPI)	-	Thailand Ministry of Commerce (MOC)
Consumer Price Index of U.S. (CPI)	-	Federal Reserve Economic Data
Stock Market Index	-	SetSmart

Foreign Direct Investment

Thailand overall's FDI on quarterly basis is from Bank of Thailand website, based on availability of quarterly FDI data on BOT website. Due to recent revamping of the website, the quarterly data is only available from year 2005 onwards.

Gross Domestic Product

Quarterly Thailand GDP is founded on Bank of Thailand website which is provided in quarterly and yearly basis.

Real Exchange Rate

Real exchange rate is the product of nominal exchange rate and the ratio of domestic price index and foreign price index. Nominal exchange rate of Thailand exchange rate against USD is data is from Bank of Thailand. However, the data is not available in quarterly format. Therefore, the end of period data is used to represent the quarterly exchange rate. Domestic price index (Thailand's) data is collected from Ministry of Commerce website which is available in yearly format. Foreign price index (United States's) data which is available in both monthly and yearly format is from FRED which is free source of global economic data.

Stock Market Index or SET Index

This research used end of period data of Thailand Stock market index or SET index from SET Smart in calculating stock market return.

3.2 Descriptive Statistics and Correlation

I also compute the correlations of the related variables for the forecast in Table 4. It reports the relationship of foreign direct investment with other variables- positive correlation on real exchange rate and SET Index. While, the change of the real exchange rate has the negative relationship with FDI. The correlation values are aligned with the prior hypothesis and mentioned empirical studies in literature review section.

Table 3: Summary Statistics

Table 3 reports the statistics summary of the focused variables in the analysis. It provides the average, median, standard deviation, minimum, and maximum value. $\ln(\text{FDI}/\text{GDP})$ is a overseas FDI to Thailand as a proportion to Thailand's GDP, RER is real exchange rate, VOL is real exchange rate volatility, Trend is time trend, and SET is return on SET index.

	<i>Mean</i>	<i>Median</i>	<i>S.D.</i>	<i>Min</i>	<i>Max</i>
$\ln(\text{FDI}/\text{GDP})$	-1.770	-1.635	0.460	-2.803	-1.030
RER	80.920	79.720	5.661	70.990	98.270
VOL	0.937	0.793	0.596	0.020	3.006
Trend	32.500	32.500	18.620	1.000	64.000
SET	0.008	0.012	0.085	-0.256	0.215

Table 4: Correlation Matrix

	$\ln(\text{FDI}/\text{GDP})$	RER	VOL	Trend	SET
$\ln(\text{FDI}/\text{GDP})$	1.000				
RER	0.334	1.000			
VOL	-0.332	-0.058	1.000		
Trend	0.005	-0.084	-0.120	1.000	
SET	0.126	-0.181	-0.209	-0.123	1.000

3.3 Stationary of Data

Ahead of conducting the regression analysis, I conducted the unit-root test, Augmented Dickery-Fuller (ADF) as Kiyota and Urata (2004) advised to test the non-stationary of all variables which unit roots may exist in the data. The equation is written as follows:

$$y_t = c + \beta \cdot t + \alpha \cdot y_{t-1} + \varphi \cdot \Delta Y_{t-1} + e_t \quad (1)$$

where y_{t-1} is lag 1 of the time series, ΔY_{t-1} is first difference of the series at time (t-1), and e_t is error term. For this research, y_{t-1} varies with Thailand FDI over GDP, real exchange rate, exchange rate volatility, and return on SET index.

Table 5: Results of ADF t-statistics

Table 5 represents the outcomes of mentioned unit root tests. The number shows the value of t-statistics. The results indicate that there is non-stationary issue for all the variables used.

	<i>ln</i> (<i>FDI/GDP</i>)	<i>RER</i>	<i>VOL</i>	<i>SET</i>
<i>without trend</i>				
Test statistics	-5.467 ***	-3.833 **	-6.781 ***	-6.583 ***
P value	0.000	0.003	0.000	0.000
<i>with trend</i>				
Test statistics	-5.439 ***	-3.887 **	-5.371 ***	-6.625 ***
P value	0.000	0.013	0.000	0.000

3.4 Optimal Lag Determination

Since this research want to deep dive into the relationship of former period of foreign direct investment flows itself and real exchange rate on foreign direct investment flows in current period. Since all the data used mentioned in prior period is the time series data is stationary from the first

order with no time lag, the vector autoregression (VAR) method is adopted to analyze the impact. Before constructing the VAR model, the optimal lag selection is derived by VAR Lag Selection method based on Akaike criterion (AIC), Schwarz Bayesian criterion (BIC), and Hannan-Quinn criterion (HQC). Regarding to Liu and Lee (2000) study, accuracy of VAR model forecast is better with shorter selection in number of lag period. The results which are shown in Table 6 suggests 1 lag length from three criteria (AIC, BIC, and HQC) for VAR model.

Table 6: Results of Optimal Lag Selection

lags	loglik	p(LR)	AIC	BIC	HQC
1	-29.568		1.104 *	1.210 *	1.145 *
2	-29.563	0.927	1.138	1.279	1.193
3	-29.543	0.839	1.171	1.347	1.239
4	-28.654	0.183	1.175	1.386	1.257
5	-27.267	0.096	1.162	1.408	1.258

Note: * indicates the lag order selected by the criterion

4. Methodology

4.1 Benchmark Model

This empirical research paper follows a proposed approach used in Kiyota and Urata (2004) with some adjustment for calculating the independent variable which is the exchange rate volatility. The main regression is mainly consisted of 2 key explanatory variables- exchange rate and exchange rate volatility.

Real exchange rate is the multiplication of nominal exchange rate and the domestic price index and divided by foreign price index. It helps measure the value of an owned-country's goods against those oversea country. It can be used to compare purchasing power between these two

countries. According to Catão (2007), RER is always measured as purchasing power comparing in terms of basket of goods i.e., consumer price index (CPI), which consists of both goods and services. The RER is derived from:

$$RER = e \cdot \frac{P^*}{P} \quad (2)$$

where RER is real exchange rate. e is nominal exchange rate. P^* is price index of goods in foreign country which P^* represents foreign price index of goods. P is domestic or target country price index of the goods. All of this, United State number is used as a peer country for benchmarking.

The real exchange rate volatility tells us about how turbulent the exchange rate is and can also be the indicator of the risk involved. Exchange rate risk refers to the possibility of investors to overlook money because of the changes in the currency. There are several ways to quantify the volatility of the currency risk. In this research paper, simple standard deviation calculation on daily real exchange rate in each quarterly period is used. It is the square root of variance that is the average squared deviation from the mean.

To derive the effect of both real FX rate and real FX rate volatility on foreign direct investment, I use the similar assumption as Kiyota and Urata (2004):

$$\ln \frac{FDI}{GDP} = \alpha_1 RER + \alpha_2 VOL + \alpha_3 Trend + \varepsilon \quad (3)$$

where the left-hand-side is proportion of foreign direct investment to GDP of Thailand. On the right side for this equation, RER is real exchange rate conducted from equations (2). VOL is real exchange rate volatility. Trend is time trend which is also included in the equation. Regarding to the

hypothesis in introduction section, I expected the coefficient of RER to be positive ($\alpha_1 > 0$) and the coefficient of VOL to be negative ($\alpha_2 < 0$).

4.2 Additional Control Variable

To extend the research beyond Kiyota and Urata (2004)'s previous study, previous empirical studies had suggested that stock market return is also an important factor in attracting foreign direct investment flows. To answer this question, I incorporated the stock market index return into the prior regression equation as control variable:

$$\ln \frac{FDI}{GDP} = \beta_1 RER + \beta_2 VOL + \beta_3 Trend + \beta_4 SET + \varepsilon \quad (4)$$

where SET is a return of SET index by the end of each quarter. As mention in the previous part, I forecasted the coefficient of RER to be positive ($\beta_1 > 0$), the coefficient of VOL to be negative ($\beta_2 < 0$), and the coefficient of SET to be positive ($\beta_4 > 0$).

4.3 Some Extension

In this section, I investigated the exchange rate and foreign direct as suggested in Aranyaratt (2011) study using vector autoregression model. Vector regression model or VAR model is adopted for analyzing the interrelated time series data:

$$y_t = A_0 + A_1 y_{t-1} + A_1 y_{t-1} + \dots A_i y_{i-1} + Q x_t + \varepsilon \quad (5)$$

where y_t is an endogenous variable, x_t is the exogenous variable, i is the greatest lag length which the lagged dependent variable is significant, and ε is the residual. The model examines the impact of previous period of both foreign direct investment and exchange rate on FDI flows as follow:

$$\ln \frac{FDI}{GDP} = \gamma_1 \ln \frac{FDI}{GDP}_{t-1} + \gamma_2 RER_{t-1} + \varepsilon \quad (6)$$

$$RER = \delta_1 RER_{t-1} + \delta_2 \ln \frac{FDI}{GDP_{t-1}} + \varepsilon \quad (7)$$

where 1 lagged in FDI flows to GDP and real exchange rate are derived from Optimal lag selection methodology in previous section (Table 6). Referring to hypothesis no. 4 and no.5 and evidence in literature review, I expect the coefficient of 1- lagged foreign direct investment flow to be not equal to 0 ($\gamma_1 \neq 0$). I also expect the coefficients of 1-lagged real exchange rate to be not equal to 0 as well ($\gamma_2 \neq 0$).

5. Result Analysis

5.1 Exchange Rate and Exchange Rate Volatility on Foreign Direct Investment Flows

Table 7 reports the result from ordinary least square of the regression equations. As shown, the coefficients of real exchange rate or RER in both models are positive and significantly different from zero at 1% significant level. Thus, there is enough evidence to support hypothesis that relationship between real exchange rate and foreign direct investment is positive. It is also aligned with the prior mentioned research that the currency depreciation of the Thai Baht attracts foreign direct investment. According to Goldberg and Hellerstein (2008), the country facing real FX rate depreciation has enhanced in the "locational advantage" or could be called as increasing attractiveness on higher investment productivity.

Real exchange rate volatility results are significantly negative throughout all the models. The sign of the real exchange rate volatility is in the opposite direction as expected that there is an adverse correlation between real exchange rate volatility and foreign direct investment. However, RER variable in model 1 reports the significant level at 1%. While it reports the significant level at 5% in the second model. The

possible reason for negative relationship is that unlike the stock market investors, risk of high volatility in exchange rate causes risk-averse investors to wary decrease their investments in uncertain situation. The results in model 1 are consistent with past literatures Kiyota and Urata (2004) because a higher in real exchange rate and lower in exchange rate risk would increase the chance of higher flows in FDI.

5.2 Exchange Rate, Exchange Rate Volatility, and Stock Exchange Market Performance on Foreign Direct Investment Flows

In model 2, I added the stock market return variable to examine the relationship of SET index return and FDI. The result of this regression is positive but not significantly distinctive from zero. Therefore, there is not enough evidence to support the prior assumption that correlation of stock market return and foreign direct investment. However, the coefficient result also supports Ramirez (2018) who documented positive relationship between stock market return and FDI.

Table 7: Regression results

The table reports the ordinary least square regression for the foreign direct investment flows. The independent variables are the real exchange rate (RER), real exchange rate volatility (VOL), time trend (Trend), and return on stock market in Thailand (SET).

<i>Model</i>	(1)	(2)
RER	0.026 *** [2.733]	0.028 *** [2.904]
VOL	-0.240 *** [-2.713]	-0.218 ** [-2.369]
Trend	-0.000 [-0.055]	0.000 [0.135]
SET		0.707 [1.078]
Constant	-3.612 -4.593	-3.839 [-4.721]
Observations	64	64
R-squared	0.210	0.225

Notes: Absolute value of t-statistics are in the brackets. * when statistically significant at significance level of 10% ($p - \text{value} < 0.1$), ** when statistically significant at significance level of 5% ($p - \text{value} < 0.05$), and *** when statistically significant at significance level of 1% ($p - \text{value} < 0.01$).

5.3 Former Period of Foreign Direct Investment and Real Exchange Rate on Current Foreign Direct Investment Flows

Table 8 reports the vector autoregression (VAR) for foreign direct investment flows to test the relationship of the lagged foreign direct investment and current foreign direct investment. The coefficient of former FDI flows is significantly positive at 1% significant level which is consistent with the hypothesis; there is relationship between former period foreign direct investment and current period foreign direct investment.

However, the coefficient of 1-lagged of real exchange rate is not significantly different from zero. Thus, there is not enough evidence to support the hypothesis that the real exchange rate is contributed to foreign direct investment flows.

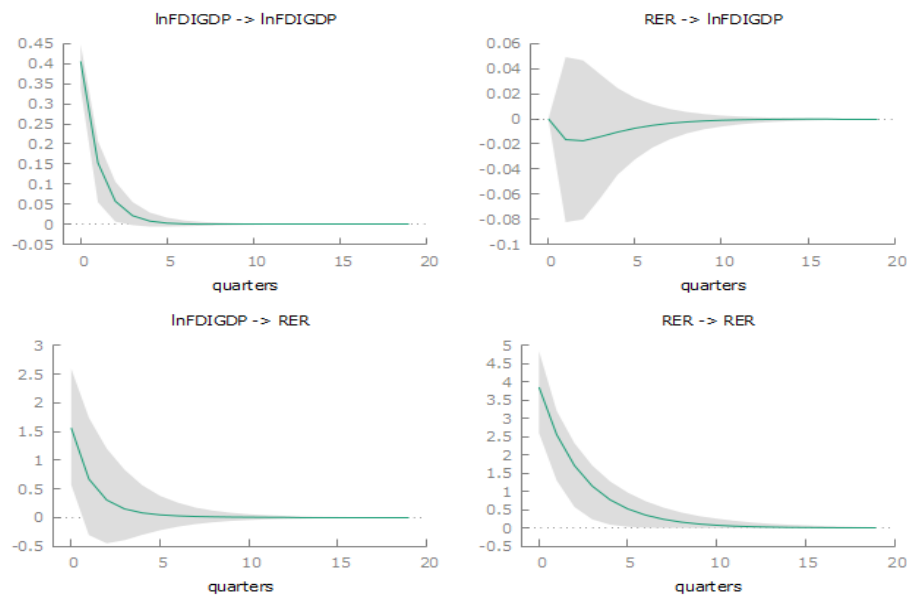
Table 8: Vector Autoregression (VAR) Results

The table reports the vector autoregression (VAR) for the foreign direct investment inflows and real exchange rate. The independent variables are the 1-lagged foreign direct investment (lnFDIGDP_1) and 1-lagged real exchange rate (RER_1).

	lnFDIGDP	RER
lnFDIGDP_1	0.393 ***	-0.902
	3.213	-0.718
RER_1	-0.004	0.662 ***
	-0.433	6.54
Constant	-0.707	25.869 ***
	-0.7863	2.805
Observations	63	63
R-squared	0.152	0.431

I also conducted the impulse response analysis which describe the relationship of FDI and real exchange rate to reflect the change degree of interested variables after applied the external pulse. They evaluate the effect on the shock variation in present or forthcoming value. According to the results in Figure 3, they can be stated that both FDI level and real exchange rate only generate effect in the early period and no effect in the later period. the response FDI to the shock of lagged FDI. The response is sharply positively decline in the early period then no effect later on. For the response of FDI to the shock of lagged real exchange rate, the response is slightly negatively decline in only the early period as well.

Figure 3: Impulse response function of the VAR “lnFDIGDP-RER



6. Conclusion

The purpose of this paper is to examine the relationship between exchange rate, exchange rate volatility, and also study the stock market return factors which might affect the foreign direct investment flows in Thailand. This research used the data of 64-period available in database during 2005 to 2020 period.

For the relationship between exchange rate and foreign direct investment, I find evidence that the currency depreciation is significantly positively related to FDI flows. The result is supported by number of previous empirical research. I also find that the exchange rate volatility has the significant relationship with foreign direct investment as the larger degree of volatility discourages the foreign direct investment to be lower. These evidences consistent with the mentioned research of Kiyota and Urata (2004) which I adopted their study as a main model.

Additionally, I extended the study topic to cover the effect of stock market return on FDI flows. The result is consistent with the hypothesis that there is the positive relationship between SET index return on FDI flows but not significant.

Furthermore, I also investigated the relationship of former period foreign direct investment($\ln\text{FDIGDP}_1$) itself and real exchange rate(RER_1) on the FDI flows via vector autoregression model (VAR). The finding suggested indicate that foreign direct and real exchange rate in former period significantly affect the FDI flows to Thailand. The results are consistent with the prior researches and hypothesis assumption that there is the positive significant relationship at 1-period lagged. The impulse

response results also suggests that the FDI in the former period responds significant in the early period to the current inward FDI flows.

I believe my empirical study has shown and provided the useful information to policy maker or related parties for planning the appropriate economics policy to encourage the foreign direct investment flows to Thailand. For example, the flexible exchange rate should be adopted with carefully monitoring the volatility to reduce the instability risk in investor's point of view. Moreover, my research on past period and current period relationship of real exchange rate and foreign direct investment itself on FDI flows could be used in enhancing the forecast model the economic data.

However, this study is limited by Thailand's data availability. Unlike the annual data, the quarterly data of foreign direct investment amount in Bank of Thailand website is only available from year 2003 onwards which in turn makes the sample size in this study become too small (64 observations are used in the analysis) as average of the statistic test in other paper has larger sample size.

APPENDIX

Table 9: Full regression results #1 (Extend from Table 7 model 1)

	coefficient	std. error	t-ratio	p-value
const	-3.613	0.787	-4.593	0.000
RER	0.026	0.009	2.733	0.008
VOL	-0.243	0.090	-2.713	0.009
Trend	-0.000	0.003	-0.055	0.956

Mean dependent var -1.770

Sum squared resid 10.539

R-squared 0.210

F(3, 60) 5.305

Log-likelihood -33.089

Schwarz criterion 82.814

rho 0.375

S.D. dependent var 0.460

S.E. of regression 0.419

Adjusted R-squared 0.170

P-value(F) 0.003

Akaike criterion 74.178

Hannan-Quinn 77.580

Durbin-Watson 1.184

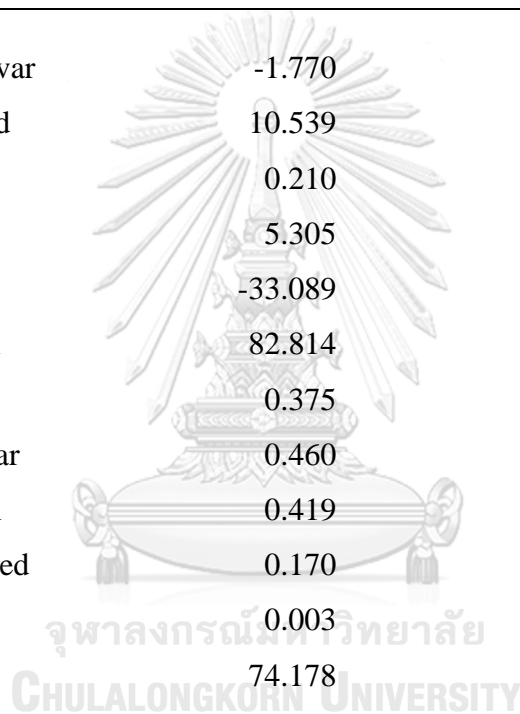


Table 10: Full regression results #2 (Extend from Table 7 model 2)

	coefficient	std. error	t-ratio	p-value
const	-3.839	0.813	-4.721	0.000
RER	0.028	0.010	2.904	0.005
VOL	-0.218	0.092	-2.369	0.021
Trend	0.000	0.003	0.135	0.893
SET	0.707	0.656	1.078	0.285
Mean dependent var	-1.770			
Sum squared resid	10.335			
R-squared	0.225			
F(4, 59)	4.280			
Log-likelihood	-32.465			
Schwarz criterion	85.724			
rho	0.403			
S.D. dependent var	0.460			
S.E. of regression	0.419			
Adjusted R-squared	0.172			
P-value(F)	0.004			
Akaike criterion	74.930			
Hannan - Quinn	79.182			
Durbin - Watson	1.141			

Table 11: Full lnFDIGDP regression results #3 (Extend from Table 8)
VAR system, lag order 1

OLS estimates, observations 2005:2-2020:4 (T = 63)

Log-likelihood = -32.579859

Determinant of covariance matrix = 0.16470557

AIC = 1.1295

BIC = 1.2316

HQC = 1.1697

Portmanteau test: LB(15) = 11.8702, df = 14 [0.6167]

	coeff.	standard error	t - ratio	p - value
constant	-0.707	0.899	-0.7863	0.434
lnFDIGDP_1	0.393	0.122	3.213	0.002***
RER_1	-0.004	0.009	-0.4338	0.666
Mean dependent var	-1.753			
Sum squared resid	10.376			
R - squared	0.152			
F(2, 60)	5.418			
rho	-0.042			
S.D. dependent var	0.444			
S.E. of regression	0.415			
Adjusted R-squared	0.124			
P-value(F)	0.006			
Durbin-Watson	2.007			
F-tests of zero restrictions:				
All lags of lnFDIGDP	F(1, 60) =	10.322	[0.0021]	
All vars, lag 1	F(1, 60) =	10.322	[0.0021]	

Table 12: Full RER regression results #4 (Extend from Table 8)

VAR system, lag order 1

OLS estimates, observations 2005:2-2020:4 (T = 63)

Log-likelihood = -179.23149

Determinant of covariance matrix = 17.32259

AIC = 5.7851

BIC = 5.8872

HQC = 5.8253

Portmanteau test: LB(15) = 13.1218, df = 14
[0.5170]

	coeff.	standard error	t - ratio	p - value
constant	25.869	9.223	2.805	0.006***
RER_1	0.662	0.101	6.54	0.000***
lnFDIGDP_1	-0.902	1.256	-0.718	0.475

Mean dependent var 81.077

Sum squared resid 1091.323

R-squared 0.431

F(2, 60) 22.725

rho 0.067

S.D. dependent var 5.562

S.E. of regression 4.264

Adjusted R-squared 0.412

P -value (F) -

Durbin - Watson 1.864

F-tests of zero restrictions:

All lags of RER F(1, 60) = 42.778 [0.0000]

All vars, lag 1 F(1, 60) = 42.778 [0.0000]

REFERENCES

- Adam, A. M., & Tweneboah, G. (2008). Macroeconomic factors and stock market movement: Evidence from Ghana. *Available at SSRN 1289842*.
- Aranyaratt, C. (2011). *The effect of exchange rate volatility on foreign direct investment and portfolio flows to Thailand* [Chulalongkorn University].
- Campa, J., & Goldberg, L. S. (1995). Investment in manufacturing, exchange rates and external exposure. *Journal of International Economics*, 38(3-4), 297-320.
- Catão, L. A. (2007). Why real exchange rates? *Finance & Development*, 44(003).
- Cheng, L. K., & Kwan, Y. K. (2000). What are the determinants of the location of foreign direct investment? The Chinese experience. *Journal of International Economics*, 51(2), 379-400.
- Cushman, D. O. (1988). Exchange-rate uncertainty and foreign direct investment in the United States. *Weltwirtschaftliches Archiv*, 124(2), 322-336.
- De Santis, R. A., & Ehling, P. (2007). Do international portfolio investors follow firms' foreign investment decisions?
- Foad, H. S. (2005). Exchange Rate Volatility and Export-Oriented FDI. *Available at SSRN 706524*.
- Froot, K. A., & Stein, J. C. (1991). Exchange rates and foreign direct investment: an imperfect capital markets approach. *The quarterly journal of economics*, 106(4), 1191-1217.
- Goldberg, P. K., & Hellerstein, R. (2008). A structural approach to explaining incomplete exchange-rate pass-through and pricing-to-market. *American Economic Review*, 98(2), 423-429.
- Head, K., & Ries, J. (1996). Inter-city competition for foreign investment: static and dynamic effects of China's incentive areas. *Journal of urban economics*, 40(1), 38-60.
- HUONG, T. T. X., Nguyen, M.-L. T., & LIEN, N. T. K. (2021). Exchange rate volatility and FDI response during the financial crisis: empirical evidence from Vietnam. *The Journal of Asian Finance, Economics and Business*, 8(3), 119-126.
- Kalim, R., & Shahbaz, M. (2009). Impact of foreign direct investment on stock market development: the case of Pakistan. *Global Conference on Business and Economics*, ISBN,
- Kiyota, K., & Urata, S. (2004). Exchange rate, exchange rate volatility and foreign direct investment. *World Economy*, 27(10), 1501-1536.
- Klien, M. W., & Rosengren, E. (1994). The Real Exchange Rate and Foreign Direct Investment in the United States. *Relative Wealth Versus Relative Wage Effects. Journal of International Economics*, 36(3/4), 373-389.
- Nucci, F., & Pozzolo, A. F. (2001). Investment and the exchange rate: An analysis with firm-level panel data. *European Economic Review*, 45(2), 259-283.
- Omorokunwa, O. G. (2018). Stock Market Performance and Foreign Capital Flow.
- Phillips, S., & Ahmadi-Esfahani, F. Z. (2008). Exchange rates and foreign direct investment: theoretical models and empirical evidence. *Australian Journal of Agricultural and Resource Economics*, 52(4), 505-525.
- Rajapakse, R. (2018). The Relationship between the Stock Market and Foreign Direct Investment (FDI) in Sri Lanka-Evidence from VAR and Co-Integration

- Analysis. *Global Journal of Management and Business Research: B Economics and Commerce*, 18(5).
- Ramirez, L. (2018). Relation between inward FDI flows and stock market development: evidence from emerging economies.
- Schmidt, C. W., & Broll, U. (2008). The effect of exchange rate risk on US foreign direct investment: An empirical analysis.
- Soumaré, I., & Tchana Tchana, F. (2015). Causality between FDI and financial market development: Evidence from emerging markets. *The World Bank Economic Review*, 29(suppl_1), S205-S216.
- Tsaurai, K. (2014). Stock market and foreign direct investment in Zimbabwe.
- Wu, J., Wang, C., Hong, J., Piperopoulos, P., & Zhuo, S. (2016). Internationalization and innovation performance of emerging market enterprises: The role of host-country institutional development. *Journal of World Business*, 51(2), 251-263.





จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

VITA

NAME Sansanee Vanapruk
DATE OF BIRTH 22 June 1995
PLACE OF BIRTH Thailand
INSTITUTIONS ATTENDED Chulalongkorn University
HOME ADDRESS 348/1 Sukhumwit 65 Phrakanongnuea Wattana
Bangkok 10110



จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY