Dynamics of the impact of currency fluctuations on Stock Exchange of Thailand:Assessing the pricing of exchange rate risk.

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This paper examines the exposure of eight Thai industries in Stock Exchange of Thailand to the exchange rate movement for the period February 2005 – December 2019 by using a panel regression analysis on a two-factor APT model. The empirical evidences on cross-sectional analysis reveal that relationship between stock returns and exchange rate movements existed during the periods with an appreciation in Thai Baht. However, no causal relationship between the two during the periods with sideway exchange rate movements. Moreover, the cross-sectional results divulge that investors in the Stock Exchange of Thailand expect a risk premium from the additional exchange rate exposure perceived by them from time to time. This implies insufficient and ineffective hedging on the exchange rate exposure by local companies in the eyes of investors. In a macroeconomic perspective, this can be inferred that Stock Exchange of Thailand and the foreign exchange market is not fully efficient.

Field of Study:	Finance	Student's Signature ....
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1. Introduction

1.1 Background

In the time of a constantly changing current situation of the today's world, it is very challenging for investors to invest in any kinds of investment. Especially, in Stock Exchange of Thailand (SET), which is one of the crucial emerging markets nowadays, making an efficient decision in investing is considered difficult, nonetheless, possible to achieve.

After the adoption of the managed float exchange rate scheme in Thailand, currency and its risk have always been crucial part of the investors' consideration. According to the Modern Portfolio Theory, investors won't willing to pay a premium for a diversified foreign exchange risk. Hence, for the multinational companies with active hedging strategies and stable earnings, the exchange rate risk should not add the firms' cost of capital nor increase value to the firm. However, Arbitrage Pricing Model pioneered by Ross (1976) suggested that if a small number of persistent factors is used to explain the economy, then these factors might be priced as a risk premium by investors to avoid these sources of risk (Ross, 2013). This could be implied under this theory that if the currency or exchange rate risk is one of those mentioned factors, then the firms' hedging strategies can indeed impact the firm's cost of capital. Conversely, Jorion (1991) research found that currency risk is not priced in the stock market. According to his results, the unconditional risk premium attached to foreign exchange rate exposure appears to be trivial and insignificant (Jorion, 1991). However, there was evidence shows that the relationship between stock returns and the foreign exchange rate varies across industries. Later, there are several other studies proposed that exchange rates fluctuation significantly effects on stock market returns. For instance, Roll (1992) revealed that fluctuating exchange rate explains most of the variation in stock's index returns for developed countries (Roll, 1992). On the similar lines, Miller and Fang (2009) by using bivariate GARCH model, they showed that a depreciation of currency significantly affects Korean equity market's performance in three perspectives: a depreciation of currency adversely impacts equity market returns, higher volatility of currency depreciation encourages higher equity market returns, and the volatility of currency depreciation elevates the volatility of equity market returns. Their evidence advocates that minor open equity markets are exposed to currency fluctuation (Fang, Lai, & Miller, 2009). In addition, Mahapatra and Bhaduri (2017), by analyzing an arbitrage pricing model with two-factors and adopting a random coefficient model, portrayed that Indian stock market returns significantly react to currency movement after the crisis, especially, during a couples of year of their sample periods. The exchange rate exposure is seemed to be a prominent determining factor of stock returns. This indicates that investors in Indian stock market are progressively expecting a premium for their additional currency exposure. (Mahapatra & Bhaduri, 2019)

To date, overall studies portray that the undiversified exchange rate exposure priced by investors is seemed to be different across place and times. In a light of the past economic situations and currency crises in the emerging countries, country like Thailand which is considered to be one of the crucial emerging countries definitely is an appropriate choice for studying. Given the international and continuously growing economy of Thailand, Thai local firms can be significantly affected by fluctuations in currency value. Thus, this study by extending an investigation focusing on Thailand, aims to investigate the dynamics of the impact on the investors' perception regarding their anticipation for exchange rate risk premiums. This paper intents to fill the space where conclusion is still inconclusive, by extending such examination to the emerging country by emphasize on Thailand for different periods of time.

Considering the past two significant financial crises, namely, The Global Financial Crisis (2007-2008) and the Euro Debt crisis (2010-2012), that shattered the world have induced a growing interest among researchers to accentuate theirs study regarding financial markets with the backdrop of the crisis years in order to better comprehend the impact of such structural breaks. The paper by P. Dua and Tuteja (2016) examining the financial contagion and cross-market relationship between the stock market and the foreign exchange markets of China, India, Japan, European countries and the United States during the previously mentioned two global crisis periods, revealed an interesting evidences that portrayed significant contagion between the asset classes, also the non-existence of the benefits of the diversification on portfolio in the stock markets as shocks afterward the crises are anyway internationally transmitted. Hence, this present paper find that it is very interesting and important for one to study the impact of such shock or instability of the exchange rate risk on the investors' perception regarding their expectation on currency risk premiums especially during such crises periods. (Dua & Tuteja, 2016)

This current paper divides the entire study period into four sub-periods with the intention to accommodate the possible structural breaks caused as a result of the financial crisis that would help us to apprehend whether or not, and how investors reacted to such instability (referring to table 1).

From figure 1, GDP growth rate emphasizes the considered possible structural breaks. Figure 2 and figure 3 show time-series plots of the changes in exchange rate series to highlight the movement in this variable in the periods of study.

Table 1: Explanation of Subsample Periods

Sub-period	Feb 2005-Dec 2007	Jan 2008-Dec 2011	Jan 2012-Dec 2015	Jan 2016-Dec 2019
Rational	Pre-crisis period of presumed overall economic stability and stable GDP growth rates.	The global financial crisis period with the initial plunge in the growth rate followed by gradual recovery, however started to decline again as approaching to the end of the period.	A crisis situation in FY 2012-2013 with another plunge in GDP growth rate and a volatile THB value, followed by gradual recovery	Post-crisis period assumed overall economic stability and less volatile of GDP growth rates.

Figure 1

Annual Growth Rate of Thai GDP

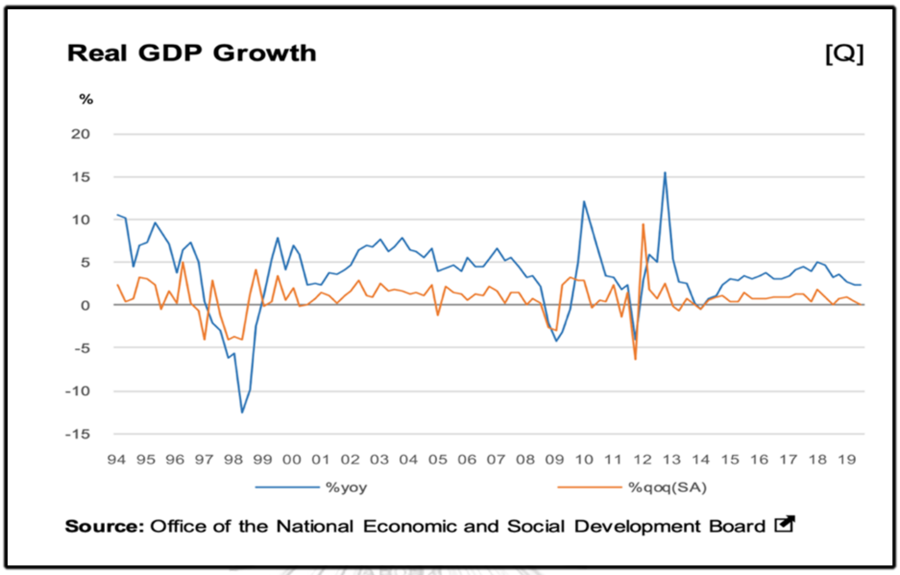


Figure 2

THB Volatility and Regional Currencies

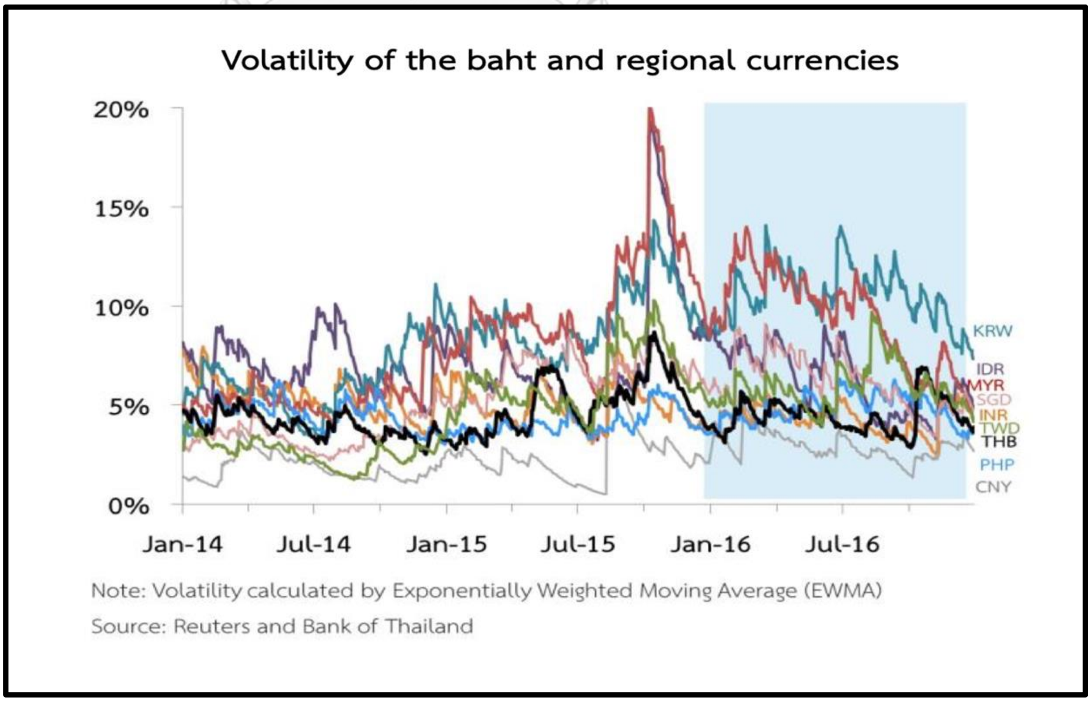
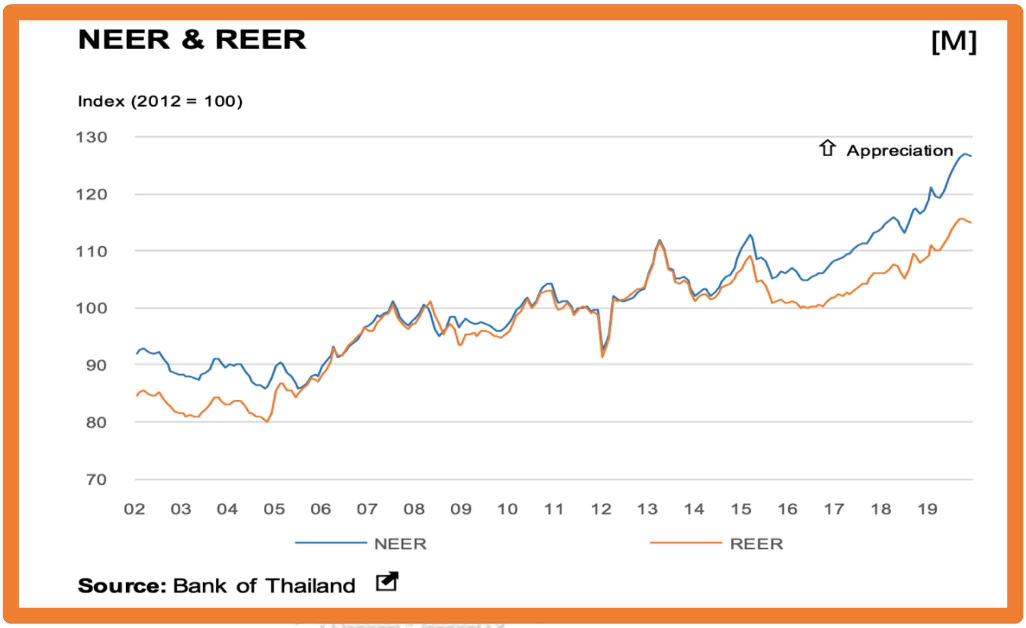


Figure 3

Thailand's Nominal and Real Exchange Rate of Return Movement Between 2002-2019



Since high currency exposure resulted from high exchange rate volatility, could lead to a change in investors' sentiments toward instability in the economy. The investors would act upon the exchange rate fluctuation by progressively expecting a risk premium on their investment for the additional exposure they encountered with. This can be implied that currency exposure significantly contributed to a demand of risk premium by investors. Therefore, in the stock market exchange rate exposures inevitably becomes a risk which is priced. Thus, this paper attempted to test is that the currency exposure is not priced as a premium by investors in Stock Exchange of Thailand during low volatility regimes. Whereas, during or around the periods of financial crisis, foreign exchange rate significantly becomes a risk that is priced in the Stock Exchange Market of Thailand (SET).

This paper is divided into six sections, the first section introduces the topic, background and objective of the study. The second section is a literature review which describes relevant research, as well as concept and theory of this analysis. The third section defines data in the analysis and explains how to derive them. The fourth section or methodology explains how to perform the tests. The fifth section describes results obtained from the analysis performed. And the last section 6, discusses and concludes the study.

1.2 Objectives

This paper aims to focus on analyzing Thai investors' reaction in terms of the changes in premium expectation from the additional exchange rate risk associated with currency vulnerability.

- By investigating the correlation between exchange rate movement and stock returns through beta coefficients.
- By analyzing whether and if so, and how exchange rate exposures are priced as risk premium by investors in the SET.

2. Literature Reviews

Table 2

Summarized Table of Literature Review

Author	Year	Title	Journal	Objective	Econometric Model	Finding
Philippe Jorion	1991	The Pricing of Exchange Rate Risk in the Stock Market	Journal of Financial and Quantitative Analysis	To analyze the pricing of foreign exchange risk in the stock market	Two-Factors Model and Multi-factors Arbitrage Pricing Models	The empirical results, do not suggest that exchange risk is prices in th stock market. The unconditional risk premium attacthed to foriegn currency exposure appears to be small and never significant. However, there is evidence showed that the relation between stock returns and the value of the dollar differs systematically across industries.
lChienChungNieha Cheng-FewLeeb	2001	Dynamic relationship between stock prices and exchange rates for G-7 countries	the quarterly review of Economics and Finance	To find and analyse the Dynamic relationship between stock prices and exchange rates for G-7 countries	OLS Regression	There is no long-run significant relationship between stock prices and exchange rates in the G-7 countries. The short-run significant relationship has only been found for one day in certain G-7 countries.
Ferson and Harvey	1994	Sources of risk and expected returns in global equity markets	Journal of Banking and Finance	To empirically examine multifactor asset pricing models for the returns on eighteen developed markets.	Multifactor asset pricing Models	The factors chosen, measure global economic risks and they conclude that foreign exchange risk is one of the most crucial factors in explaining international equity index returns.
De Santis and Gerald	1998	How big is the premium for currency risk?	Journal of Finance Economics	To estimate and test the conditional version of an International Capital Asset Pricing Model using a parsimonious multivariate GARCH process.	Parsimonious multivariate GARCH process	The findings strongly support a model which includes both market and foreign exchange risk. However, both sources of risk are only detected when their prices are allowed to change over time. The evidence also indicates that, with the exception of the U.S. equity market, the premium for bearing currency risk often represents a significant fraction of the total premium.
Patro, Wald and Wu	2002	Explaining exchange rate risk in world stock world stock markets: A panel approach	Journal of Banking and Finance	To estimate a time-varying two-factor international asset pricing model for weekly equity index returns of 16 OECD countries, by using a trade-weighted basket of exchange rates and the MSCI world market index as risk factors.	GARCH framework with a panel approach	The study reports significant currency risk exposures in country equity index returns
Aquino	2005	Exchange rate risk and Philipine stock return : before and after the Asian financial crisis	Applied Financial Economics	To investigates the foreign exchange exposure faced by Philippine firms around the Asian Financial crisis period (1992-2001)	Two-factor asset pricing model, using a random coefficient model and GLS Seemingly Unrelated Regression	The study finds that while stock returns were not impacted by the exchange rate fluctuations before the crisis, there was a significant impact of the fluctuations in stock returns after crisis i.e. after 1997. the study also finds that during the post-crisis period, investors started expecting a premium on their investments for their added exposure to exchange rate risk as perceived by them.
Smita Mahapatra*, Saumitra N. Bhaduri	2018	Dynamics of the impact of currency fluctuations on stock markets in India: Assessing the pricing of exchange rate risks	Borsa Istanbul Review	To study the dynamics of the impact of currency fluctuation on Indian stock market by assessing the pricing of exchange rate risk during the period 2005-2016, specifically before and after financial crises.	Two-factor asset pricing model, using a random coefficient model	There is an evidence that stock returns react significantly to foreign exchange rate fluctuations in the post-crisis period. Particularly, during the last four years of our sample, 2012-2016, the exchange rate risk factor is becoming a prominent determinant of stock returns, indicating that Indian investors are increasingly expecting a risk premium on their investment for their added exposure to exchange rate risk.
Chkili and Nguyen	2014	Exchange rate movements and stock market returns in a regime-switching environment:Evidence for BRICS countries	Research in International Business and Finance	To investigate the dynamic relationship between stock markets and exchange rates for the BRICS nations between the year 1997 and 2013.	Markov Switching model	The result suggests that stock markets have more influence on exchange rates during both low and high volatility periods.

According to Jorion (1991)'s paper, by performing a test on a sample of value-weighted industry portfolios, it suggested that in the case of exporting-oriented industries, the impact of currency depreciation is considered favorably toward the firms and investors (Jorion, 1991). Since the declining in exchange rate, implies that their goods are cheaper than their competitors, this provides an opportunity to generate more revenue for the firms. This positive view on the impact will ultimately increase their stock prices. Thus, primarily export- oriented industries are believed to display a significantly positive exposure, meaning that when the value of currency falls, the export-oriented industries stock returns will increase. On the contrary, import-oriented industries have adverse views toward the impact of currency depreciation so that they display negative exchange rate exposure, meaning that when the currency depreciates, their stock prices and returns tends to fall. This can be implied that, this significant of cross-sectional differences between industries can be studied by accentuating on the fact that the more the foreign exchange exposure of the industry which measured from their net trade balance, the more their sensitivity to exchange rate exposure.

Aquino (2005) inspects the exchange rate risk encountered by Philippine firms during the Asian financial crisis period between 1992 and 2001, by using two-factor APT model. His results suggested that even though, before the crisis there was no correlation between foreign exchange fluctuations and stock returns. However, after the crisis i.e. after 1997, the exchange rate fluctuations had a significant impact on the Philippine stock returns. (Aquino, 2005)

On the same line, Mahapatra and Bhaduri (2017), high currency exposure resulted from high exchange rate volatility, could lead to a change in investors' sentiments toward instability in the economy. The investors would act upon the fluctuation from exchange rate risk by expecting more and more of risk premium for the additional risk (Mahapatra & Bhaduri, 2019). This can be implied that currency exposure significantly contributed to a demand of risk premium by investors. Hence, currency exposure is a risk which is priced in the equity market.

3. Research hypothesis

The model used for the paper's analysis is adopted from a study by Jorion (1991) which Ross's approach of Arbitrage Pricing Theory is used. (Jorion, 1991)

The two-factor model of Ross (1976) APT infers a linear correlation between expected returns and the market sensitivity and exchange rate movements sensitivity. (Ross, 2013)

$$E(\tilde{R}_i) = \delta_0 + \delta_1\beta_i^m + \delta_s\beta_i^s \qquad (1)$$

Where,

β_i^m : ith stock's sensitivity to market movements

β_i^s : ith stock's sensitivity to exchange rate movements.

If exchange rate fluctuations are not considered a main cause of risk or if both stock returns and exchange rates are generated by the same original factors, then individual stock returns may not exhibit any sensitivity to exchange rate fluctuations after accounting for the effects of the original factors channeled through their effects on aggregate market returns. Thus, in the model to be tested, exchange rate movements will be orthogonal by construction to market returns ($\beta_s^m = 0$), in accordance with the assumptions of Ross (1976) original APT formulation, this implies

$$E(\tilde{R}_i) = \delta_0 + [E(\tilde{R}_m) - \delta_0]\beta_i^m + \delta_s\beta_i^s \tag{2}$$

Notice that if $\delta_0 = \delta_s = 0$, this is the Sharp-Lintner capital asset pricing model or CAPM.

Time series of returns can be expressed as the following with stationary assumption;

$$\tilde{R}_{it} = E(\tilde{R}_{it}) + \beta_i^m[\tilde{R}_m - E(\tilde{R}_m)] + \beta_i^s\tilde{F}_{st} + \tilde{\varepsilon}_{it} \tag{3}$$

where,

$\tilde{F}_{st}$: Residual of the regression of the exchange rate movement against the rate of return:

$$\tilde{F}_{st} = \tilde{R}_{st} - (\hat{\gamma}_0 + \hat{\gamma}_1 \tilde{R}_{mt}) \quad (4)$$

Under rational expectations, substituting (2) in (3) yields:

$$\tilde{R}_{it} = [\delta_0 (1 - \beta_i^m) + \delta_s \beta_i^s] + \beta_i^m \tilde{R}_t^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it} \quad (5)$$

This is the restricted model to be tested.

Exchange rate exposure is priced if the coefficient δ_s is non-zero, which could imply a rejection of mean-variance efficiency of the market.

The unrestricted equation is given by

$$\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_t^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it} \quad (6)$$

Given the restricted and unrestricted models, the cross-section restriction is tested by a likelihood ratio test.

4. Data

This paper uses secondary data for the analysis.

4.1 $\tilde{R}_{it}$

The dependent variable, $\tilde{R}_{it}$ in the test equation, representing series of excess returns over risk-free rate of individual firms 'stocks. The data was obtained from Thompson Reuter Eikon Datastream. All the companies in Stock Exchange of Thailand (SET) have been included in the study. The monthly adjusted closing prices data for each of these firms from January 2005 to December 2019 were collected. During step 3 methodology, company's stock returns will be categorized into 8 portfolios as specified in SET as the followings;

The portfolios are:

1. Agro & Food Industry
2. Consumer Products
3. Financials
4. Industrials
5. Property & Construction
6. Resources
7. Services
8. Technology

4.2 $\tilde{R}_t^m$

The variable $\tilde{R}_t^m$, representing series of the market risk premium is monthly closing prices data which obtained and calculated from the Thompson Reuter Eikon Datastream. This paper applies SET index as the market portfolio. Its return is computed monthly from the Total Return Index which already includes the stocks' price movement effects (capital gain/loss), right offered, and dividend income to current shareholders of the company. For the risk free rate, the one-month yield to maturity of Treasury bill at the beginning of each month is collected from ThaiBMA website and used.

4.3 $\tilde{R}_t^s$

The independent variable in the test equation is $\tilde{R}_t^s$, representing series of exchange rate. This variable was calculated from the USD-THB monthly average exchange rates gathered from The Bank of Thailand (BOT) website.

4.4 $\tilde{F}_t^s$

Another independent variable in the test equation is $\tilde{F}_t^s$, representing the residual of the regression of the exchange rate movement against the rate of return on the stock market.

In this paper, "returns" which is the rate of change of each of the mentioned variables were calculated as the natural log of the ratio of prices of one period to its preceding period. By assuming that prices are distributed lognormally, it can be implied that log returns will follow a normal distribution, which is a major benefit of this method.

The timeline for this study is between January 2005- December 2019. However, the returns data begin from February 2005 since it is collated as a ratio of current to the previous time period. The paper divides the whole study period into four sub-sample periods. This would provide an opportunity to accommodate the possible structural breaks caused resulted from such financial crisis. By doing do, it could help us to better perceive and understand whether, and how Thai investors responded to such instability.

5. Methodology

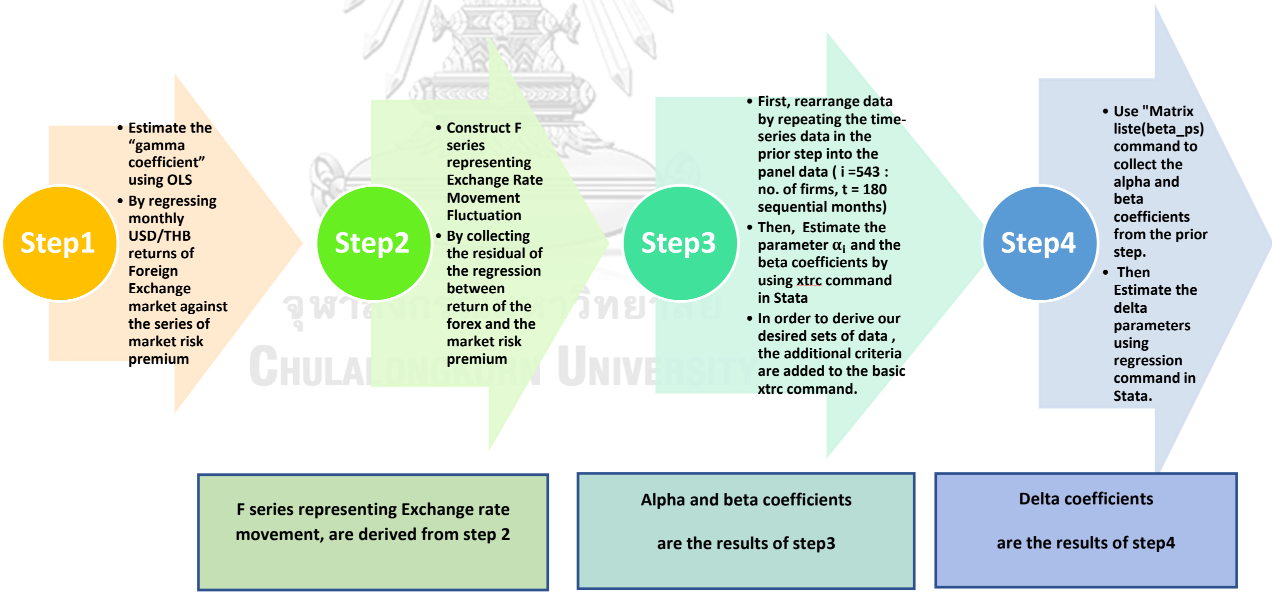


Diagram 1: Summary of Methodology Steps

Step 1: Estimate the parameters, $\hat{\gamma}_0$ and $\hat{\gamma}_1$ from the following test equation by using Ordinary Lease Squares regression.

$$\tilde{R}_t^s = (\hat{\gamma}_0 + \hat{\gamma}_1 \tilde{R}_t^m)$$

where $\tilde{R}_t^s$ is the exchange rate return series

$\tilde{R}_t^m$ is the series of the market risk premium

Step 2: Construct $\tilde{F}_{st}$ series, which represent residual of the regression of the exchange rate movement against the rate of return on the stock market from the following equation.

$$\boldsymbol{\tilde{F}_t^s = \tilde{R}_t^s - (\hat{\gamma}_0 + \hat{\gamma}_1 \tilde{R}_t^m)}$$

This $\tilde{F}_{st}$ series or exchange rate fluctuation is later used as the second independent variable in the test equation in step 3.

Note that step 1 and step 2 can be conducted simultaneously in Microsoft excel. By simply use regression function in the excel and collect the series of residual to use as our $\tilde{F}_{st}$ series.

Step 3: Estimate the parameter α_i and the beta coefficients $\beta_i^m and\ \beta_i^s$ from the following equation, by using the 'xtrc' function in the software Stata in which the Swamy Random Coefficient model is applied (Swamy, 1970).

$$\boldsymbol{\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}}$$

However, prior to the step of random coefficient regression, the data sets of $\tilde{R}_t^m and\ \tilde{F}_t^s$ from the previous step must be rearranged first, by repeating the time-series data into the whole panel data with the matrix of " i "=543; i denotes total numbers of firms in the analysis, and "t" =180; t denotes a series of sequential months for the total of 180 sample periods (from our study period of 15 years, total t periods are 180 periods (12x15). Then, an estimation of the parameter α_{it} and the beta coefficients can be conducted by using Xtrc command in Stata. In order to categorize the whole set of our panel data into the set of data that we desired; we need to add some criteria to the basic xtrc command. This is to classify the companies returns data into the industry's data, also from the whole sample period into our pre-determined sub-periods (refer to appendix).

The beta outcomes from step 3 regression are $\boldsymbol{\beta_i^m}$ representing the market exposure and $\boldsymbol{\beta_i^s}$ representing exchange rate exposure for the companies in the specified industries at different time unit. These beta coefficients are the estimated beta derived from xtrc regression result for the firms in the pre-specified sub-group of industry and time period. Thus, it can be observed that numbers of alpha and beta coefficients, vary across the set of xtrc commands depending on the criteria that we use to classify our data. (see appendix 4).

Note that random Coefficient Effects model is used with the kind of panel data we have. This is because according to Hsiao and Perasan (2004), the conventional random effect models do not allow the interaction of the individual specific and/or time varying differences in the included explanatory variables (Hsiao & Pesaran, 2004). Due to the advantages that Random coefficients models provide especially in terms of degrees of freedom and simplified computation, the present study chooses to use this estimation technique. The random coefficient models assume that the individual specific regression parameters are random, for example, each represents a draw from a population. All the variants of these type of models are a case of the more general class of linear mixed effects models. Linear mixed effects model can be thought of as extensions of linear regression models for the case where data needs to be summarized in groups. In Swamy's Random Coefficient linear regression models, rather than only the intercept varying across groups, all the coefficients can vary as well. (Swamy, 1970)

Step 4: To obtain the alpha and beta coefficient values from the previous step in Stata,

"Matrix list e(beta_ps)" command is used to collect the alpha and beta coefficients right after conducting regression in step 3. Then, the following equation would be estimated by regression in Stata in order to find the parameters δ_0 *and* δ_s

$$\boldsymbol{\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s \beta_i^s}$$

Testing the above equation for all our specified groups with the null hypothesis that the risk premium coefficient δ_s, representing the pricing of exchange rate exposure, is constant at zero.

$H_{0:}\ \boldsymbol{\delta_s} = 0$

$H_{1:}\ \boldsymbol{\delta_s} \neq 0$

6. Empirical Results

The test equation $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$ has been estimate by panel regression model with random coefficient. The values of β_i^m and β_i^s together with statistics and p-values of various periods are presented in the following tables.

Table 4: Cross-Sectional Market and Exchange Rate Exposure for the period of Feb 2005- Dec 2019 (Whole Period); Model: $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

No.	Industry	β_i^m				β_i^s		
		Coeff	z-stat	p-value		Coeff	z-stat	p-value
1	Agro & Food Industry	0.921470	0.85	0.000	***	0.135396	0.95	0.342
2	Consumer Products	0.655252	7.22	0.000	***	0.181158	1.07	0.284
3	Financials	0.845706	12.00	0.000	***	0.045867	0.40	0.692
4	Industrials	0.829946	19.47	0.000	***	0.067128	0.75	0.450
5	Property & Construction	0.818398	15.12	0.000	***	0.065067	0.78	0.437
6	Resources	1.066264	10.60	0.000	***	0.125945	0.70	0.481
7	Services	0.835231	15.50	0.000	***	0.078638	0.82	0.413
8	Technology	0.773087	6.57	0.000	***	-0.004191	-0.02	0.981

*** Significant at 1%
** Significant at 5%
* Significant at 10%

According to table 4, for all industries in a full sample period (February 2005 to December 2019), the null hypothesis is rejected at 5% significant level for the market exposure (β_i^m). Whereas the exchange rate exposure (β_i^s) for all the industries is not rejected at 5% significant level. The significant beta coefficients of the market risk premium indicate that there is a causal relationship between the exchange rate movement and the industries portfolio's returns. However, the insignificant beta coefficients representing currency exposure show no causal relationship between exchange rate fluctuation and returns of stock for all industries. It suggests that for the whole studied period stock returns don't react to exchange rate movement. The findings are inconsistent with the studies from (Aquino, 2005) and (Mahapatra & Bhaduri, 2019) , however, corroborated with the literature of Chien-Hsiu Lin (2012), in which there is no long-term relationships between exchange rates fluctuation and stock prices exist (Lin, 2012). This emphasize the importance of extending the analysis into sub-periods.

Table 5: Cross-Sectional Market and Exchange Rate Exposure for the period of Feb 2005- Dec 2007 (1st Sub-Period) ; Model: $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

No.	Industry	β_i^m				β_i^s		
		Coeff	z-stat	p-value		Coeff	z-stat	p-value
1	Agro & Food Industry	0.758435	4.80	0.000000	***	0.213358	0.52	0.606
2	Consumer Products	0.504236	3.32	0.001000	***	-0.006011	-0.02	0.987
3	Financials	0.767675	6.25	0.000000	***	0.322476	1.71	0.088
4	Industrials	0.620788	8.45	0.000000	***	-0.248141	-0.99	0.323
5	Property & Construction	0.810722	10.51	0.000000	***	-0.266380	-1.26	0.209
6	Resources	1.068958	3.30	0.001000	***	0.552297	0.67	0.503
7	Services	0.662326	7.54	0.000000	***	-0.415541	-0.20	0.841
8	Technology	0.639777	4.51	0.000000	***	-0.106863	-0.23	0.818

*** Significant at 1%
** Significant at 5%
* Significant at 10%

For the first sub-period (February 2005 to December 2007), which the market is tranquil before the Global crisis period, the null hypothesis on the market exposure (β_i^m) is rejected at 1% significant level for all eight industries. However, all industries reveal insignificant beta coefficients. Thus, this period doesn't reveal any meaningful statistical relationship between industries' stock returns and exchange rate movement even we scrutinize into sub-period.

Table 6: Cross-Sectional Market and Exchange Rate Exposure for the period of Jan 2008- Dec 2011 (2nd Sub-Period); Model: $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

No.	Industry	β_i^m				β_i^s			
		Coeff	z-stat	p-value		Coeff	z-stat	p-value	
1	Agro & Food Industry	0.806895	8.82	0.000	***	0.000625	0.00	0.998	
2	Consumer Products	0.617907	6.79	0.000	***	-0.066418	-0.24	0.813	
3	Financials	0.826964	10.24	0.000	***	-0.520049	-1.81	0.070	
4	Industrials	0.761504	16.59	0.000	***	-0.106343	-0.47	0.638	
5	Property & Construction	0.857862	14.40	0.000	***	-0.475439	-2.66	0.008	***
6	Resources	0.948679	7.59	0.000	***	-0.590575	-1.14	0.255	
7	Services	0.743877	14.31	0.000	***	-0.087496	-0.48	0.631	
8	Technology	0.632501	6.10	0.000	***	0.111377	0.25	0.802	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table 6, representing the empirical outcomes of second period which there was global financial crisis (January 2008 – December 2011), portrays that for all industries, the null hypothesis is rejected for the market exposure (β_i^m). However, Property & Construction industry reveal that its null hypothesis on exchange rate exposure is rejected at 5% significant level. The industry demonstrates the significant negative beta coefficient of -0.4754. This implies that its portfolio's returns adversely react to the fluctuation of USD-THB exchange rate movement.

Table 7: Cross-Sectional Market and Exchange Rate Exposure for the period of Jan 2012- Dec 2015 (3rd Sub-Period); Model: $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

No.	Industry	β_i^m				β_i^s		
		Coeff	z-stat	p-value		Coeff	z-stat	p-value
1	Agro & Food Industry	0.977610	9.37	0.000	***	-0.183995	-0.83	0.408
2	Consumer Products	0.767481	4.88	0.000	***	0.146288	0.42	0.674
3	Financials	0.837997	8.99	0.000	***	-0.207648	-0.94	0.346
4	Industrials	0.910722	13.90	0.000	***	-0.248512	-1.39	0.164
5	Property & Construction	0.852320	11.33	0.000	***	-0.147391	-0.86	0.389
6	Resources	1.096326	7.16	0.000	***	0.169225	0.56	0.573
7	Services	0.998516	12.46	0.000	***	-0.243991	-1.31	0.189
8	Technology	0.838302	6.83	0.000	***	-0.073069	-0.27	0.784

*** Significant at 1%
** Significant at 5%
* Significant at 10%

On the same line with the first sub-sample period, table 7 representing the analysis results of third period ranging from January 2012 to December 2015, portrays that for all industries, the null hypothesis is rejected on the market exposure (β_i^m) but not rejected on exchange rate exposure (β_i^s) when tested. Again, this period doesn't show any meaningful statistical evidence that industries' stock returns react to exchange rate movement even we scrutinize into sub-period.

Table 8: Cross-Sectional Market and Exchange Rate Exposure for the period of Jan 2016- Dec 2019 (4th Sub-Period); Model: $\tilde{R}_{it} = \alpha_i + \beta_i^m \tilde{R}_{it}^m + \beta_i^s \tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

No.	Industry	β_i^m				β_i^s			
		Coeff	z-stat	p-value		Coeff	z-stat	p-value	
1	Agro & Food Industry	0.985317	9.12	0.000	***	0.4299376	2.01	0.044	**
2	Consumer Products	0.624123	5.51	0.000	***	0.051552	0.24	0.812	
3	Financials	0.877365	9.46	0.000	***	0.0686211	0.40	0.687	
4	Industrials	0.939384	11.98	0.000	***	0.2971289	1.85	0.064	*
5	Property & Construction	0.782671	10.95	0.000	***	0.4364473	3.16	0.002	***
6	Resources	1.052849	7.58	0.000	***	0.3679149	1.20	0.230	
7	Services	0.908118	11.12	0.000	***	0.338215	2.39	0.017	**
8	Technology	0.929488	5.91	0.000	***	0.0001636	0.00	1.000	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

For the last sub-period ranging from January 2005 to December 2019, the null hypothesis is rejected for both the market return series and for the exchange rate movements. For the null hypothesis on market exposure (β_i^m), all the eight industries show significant positive beta coefficient at 5% significant level. For the null hypothesis on (β_i^s) denoting exchange rate exposure.

For the null hypothesis on exchange rate exposure (β_i^s), Property & Construction shows 1% significant positive beta coefficient value of 0.4364. While Agro & Food and Services Industries reveal positive beta coefficients at 5% significant level values of 0.4299 and 0.3382 respectively. Also, Industrials' null hypothesis is rejected at 10% significant level with the positive beta coefficient value of 0.2971

It can be observed that after conducting the cross-sectional in the scope of time, the sub-period empirical evidence reveals more meaningful statistical results. Two sub-period results of the global financial crisis period (2008-2011) and especially the post-crisis period (2016 – 2019) shown in table 6 and table 8 respectively, exhibit different outcomes from the entire sample period. The two sub-period empirical results portray that there is significant causal relationship between stock returns and the exchange rate movement. This implies that firms in the industries with significant beta coefficients are perceived to have direct or indirect exchange rate exposures that are not entirely hedged either via ownership of risk-offsetting assets or the use of currency derivatives such as currency forwards, futures and options.

According to table 6, “Property and Construction Industry” displayed a significant negative exposure in the second sub-period for January 2008 – December 2011 (global financial crisis period). The negative beta coefficient can be implied that a positive change in the exchange rate movement representing currency depreciation decreases returns for the significant beta coefficient industry’s portfolio. This could be inferred that during the particular period such industry is imported-oriented industry which tend to import a substantial portion of its inputs from foreign countries, hence it tends to be vulnerable to currency depreciation.

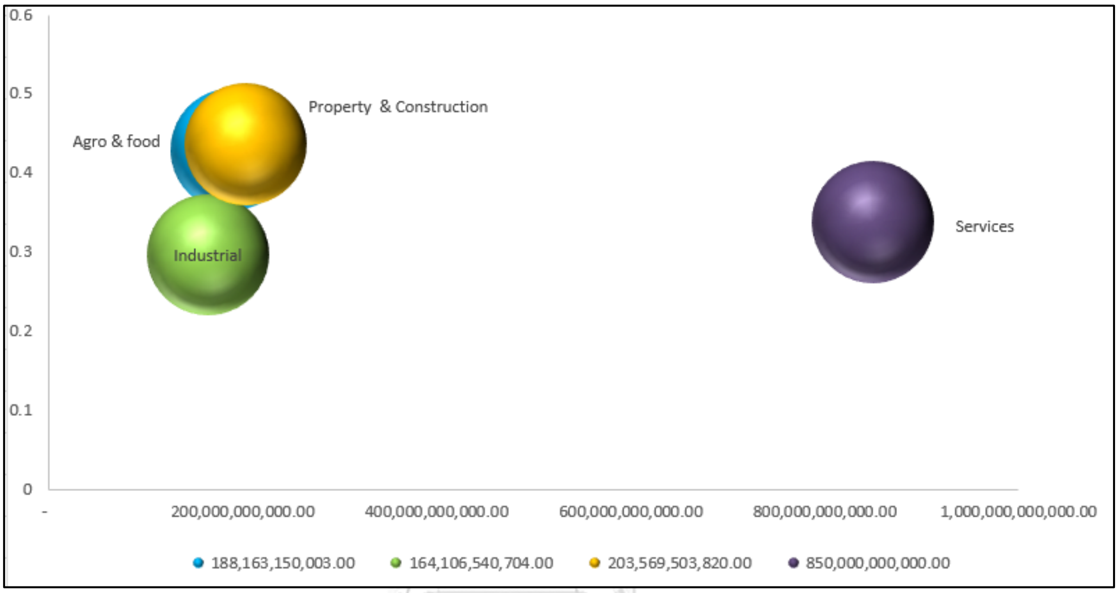
Contrarily, for the fourth sub-period of the analysis, four industries which are “Agro & food, Industrials, Property & Construction and Service” industries show significant positive exposures. The positive beta coefficient can be implied that a positive change in the exchange rate movement representing currency depreciation, which in this study referred to Thai Baht depreciation, increase returns for the significant beta coefficient portfolios. This indicates that the firms in the industries with significant positive beta coefficient are considered to be in export-oriented industries where the exchange rate movement especially depreciation plays a crucial role in the firms’ international competitive advantages

In order to validate the previous mentioned hypothesis, the exchange rate exposures (β^s)for each individual industry portfolios were plotted against its net export balance in the following figure 4. According to the figure 4, it could be observed that all the industries with significant positive beta coefficients (β^s) are indeed export-oriented industries with the positive net export balance for the year 2019.

Figure 4

Exchange Rate Exposure of Industry Portfolios with respect to their

Net Export Balance for 2019



Data Source: For Agro & Food industry, Industrials and Property & Construction industry, the net export balances are from Custom department in 2019. For Services industry, the data are from the Ministry of Tourism & Sports.

After obtaining beta coefficient values form the prior test, and plugging them into the last test equation of $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s\beta_i^s$. The values of delta coefficients (δ_0 and δ_s) along with their statistics and p-values for various periods are presented in the following tables.

Table 9: Tests of Pricing of Exchange Rate Exposure (Monthly data) for the period of Feb 2005- Dec 2019 (Whole Period); Model: $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s\beta_i^s$

No.	Industry	δ_0 Coeff	δ_0 t-stat	δ_0 p-value		δ_s Coeff	δ_s t-stat	δ_s p-value	
1	Agro & Food Industry	0.008151	9.28	0.000	***	0.001748	1.38	0.173	
2	Consumer Products	0.007784	6.42	0.000	***	-0.003306	-2.52	0.017	**
3	Financials	0.006184	3.41	0.001	***	-0.000995	-0.38	0.706	
4	Industrials	0.006706	6.31	0.000	***	0.004415	4.02	0.000	***
5	Property & Construction	0.006844	5.92	0.000	***	-0.005050	-2.86	0.005	***
6	Resources	0.002366	0.78	0.442		-0.006062	-1.53	0.139	
7	Services	0.011056	7.90	0.000	***	0.001440	0.86	0.391	
8	Technology	0.007130	2.70	0.012	**	0.004359	1.16	0.257	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table 9 representing empirical results for the full sample period show that δ_0 coefficient representing the pricing of undiversified exposure can be rejected at 5% significant level for most of the industries except for Resources industry. The risk premium coefficient δ_s representing the pricing of exchange rate exposure for industries of Industrials and Property & Construction are rejected at 1% significant level with the coefficient values of 0.004415 and -0.005050 correspondingly. While the null hypothesis of Consumer Products industry is rejected at 5% significant level with the negative coefficient value of -0.003306

My interpretation on the exchange rate risk premium pricing from the test equation $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s\beta_i^s$ is the followings; positive exchange rate risk premium coefficient implies that investors perceive the currency exposure as the risk that hasn't been fully hedged and has a direct relationship with stock return. Hence when the exchange rate exposure increases, investors react to their additional perceived risk by demanding for an increasing in the stock returns. On the contrary, negative exchange rate risk premium coefficient indicates adverse relationship between stock returns and exchange rate exposure. This implies that industry portfolio's stock returns decrease when the exchange rate exposure increase.

Table 10: Tests of Pricing of Exchange Rate Exposure for the period of Feb 2005- Dec 2007 (1st Sub-Period); Model: $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s \beta_i^s$

No.	Industry	δ_0 Coeff	t-stat	p-value		δ_s Coeff	t-stat	p-value	
1	Agro & Food Industry	0.002216	0.92	0.366		-0.002455	-1.91	0.065	*
2	Consumer Products	0.008803	2.61	0.016	**	0.006466	2.39	0.025	**
3	Financials	0.011977	3.32	0.002	***	0.010636	1.57	0.125	
4	Industrials	0.026586	11.14	0.000	***	0.009410	7.52	0.000	***
5	Property & Construction	-0.019304	-4.60	0.000	***	-0.002143	-0.84	0.402	
6	Resources	0.018003	5.05	0.000	***	0.009228	5.41	0.000	***
7	Services	0.021925	9.71	0.000	***	0.007790	4.36	0.000	***
8	Technology	0.032636	4.11	0.001	***	0.004819	1.30	0.212	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Refer to table 10, the results for the first sub-period period show that δ_0 coefficient representing the pricing of undiversified exposures of the portfolio can be rejected at 5% significant level for most of the industries except for Agro & Food Industry.

Industrials, Resources, and Services portray the 1% significant positive exchange rate risk premium coefficient values of 0.009410, 0.009228, and 0.007790 respectively. The null hypothesis of δ_s of Consumer Products Industry is also rejected at 5% significant level with the positive value of 0.006466. Lastly, Agro & Food Industry's null hypothesis of δ_s is rejected at 10% significant level with the negative value of -0.002455 as well. This indicates that exchange rate exposures are priced on stock returns by the investors in Stock Exchange of Thailand in this period when our test is dissected into sub-periods.

Table 11: Tests of Pricing of Exchange Rate Exposure for the period of Jan 2008-Dec 2011 (2nd Sub-Period); Model: $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s\beta_i^s$

No.	Industry	δ_0 Coeff	δ_0 t-stat	δ_0 p-value		δ_s Coeff	δ_s t-stat	δ_s p-value	
1	Agro & Food Industry	0.009567	2.56	0.014	**	0.004113	0.87	0.389	
2	Consumer Products	0.008293	3.66	0.001	***	0.000945	0.34	0.735	
3	Financials	0.010508	4.03	0.000	***	0.000473	0.30	0.764	
4	Industrials	0.007269	3.85	0.000	***	-0.002672	-2.87	0.005	***
5	Property & Construction	0.005436	3.20	0.002	***	0.002705	1.91	0.060	*
6	Resources	0.002933	1.22	0.242		0.001997	1.51	0.152	
7	Services	0.008218	3.11	0.003	***	0.001103	0.59	0.555	
8	Technology	0.002970	0.64	0.533		0.000609	0.32	0.753	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

The results propose that the risk premium coefficients δ_s representing the pricing of exchange rate exposure are at 1% significant level for Industrials with the negative value of -0.002672. This implies that Industrials' stock returns are adversely priced in this period when the exchange rate exposures increase. Whereas Property & Construction Industry shows the positive delta coefficient value of 0.002705 at 10% significant level. This indicates that stock returns has direct relationship with the exchange rate exposure in which when such exposure increases, investors would expect extra premium for an additional risk encountered by them.

On the same fashion with the prior periods, δ_0 representing the pricing of undiversified exposure can be rejected in most of industries at 5% significant level, except for Resources and Technology.

Table 12: Tests of Pricing of Exchange Rate Exposure for the period of Jan 2012-Dec 2015 (3rd Sub-Period); Model: $\alpha_i = \delta_0(1 - \beta_i^m) + \delta_s\beta_i^s$

No.	Industry	δ_0 Coeff	δ_0 t-stat	δ_0 p-value		δ_s Coeff	δ_s t-stat	δ_s p-value	
1	Agro & Food Industry	0.003353	0.75	0.459		-0.013687	-2.87	0.006	***
2	Consumer Products	0.001356	0.59	0.561		-0.003426	-2.15	0.040	**
3	Financials	0.000293	0.08	0.933		-0.013557	-5.74	0.000	***
4	Industrials	-0.000509	-0.22	0.823		-0.001600	-1.31	0.193	
5	Property & Construction	-0.001941	-1.22	0.224		-0.001830	-1.38	0.172	
6	Resources	0.002384	0.45	0.653		-0.005244	-0.85	0.404	
7	Services	0.004693	2.28	0.025	**	-0.006462	-4.61	0.000	***
8	Technology	0.003556	1.14	0.266		0.000494	0.15	0.880	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Refer to table 12 for the period of January 2012 to December, the risk premium coefficients δ_s representing the pricing of exchange rate exposure industries, can be rejected at 5% significant level for Agro & Food, Consumer Products, Financial, and Services industries. All the mention industries show significant negative value of -0.013687, -0.003426, -0.013557 and -0.006462. This implies that exchange rate exposures are negatively priced in this period. While only Services industry shows positive value of δ_0 coefficient at 5% significant level. This indicates that for this period, idiosyncratic exposure premium is not the main factor of alpha or excess return over the market, for most of the industries.

Table 13: Tests of Pricing of Exchange Rate Exposure for the period of Jan 2016-Dec 2019; Model: $\alpha_i = \delta_0(1-\beta_i^m) + \delta_s\beta_i^s$

No.	Industry	δ_0 Coeff	δ_0 t-stat	δ_0 p-value		δ_s Coeff	δ_s t-stat	δ_s p-value	
1	Agro & Food Industry	0.009028	4.19	0.000	***	0.003143	1.61	0.114	
2	Consumer Products	0.018869	11.10	0.000	***	-0.000904	-0.48	0.632	
3	Financials	0.011591	4.02	0.000	***	-0.003630	-1.23	0.226	
4	Industrials	0.013008	10.40	0.000	***	0.003082	3.09	0.002	***
5	Property & Construction	0.004705	3.35	0.001	***	-0.008370	-6.47	0.000	***
6	Resources	-0.004047	-1.48	0.152		-0.003782	-2.08	0.048	**
7	Services	0.006986	5.62	0.000	***	0.000662	0.51	0.613	
8	Technology	0.006904	2.09	0.047	**	-0.002366	-0.90	0.379	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

For the last sub-period, δ_0 representing idiosyncratic risk pricing can be rejected at 5% significant level with the positive coefficient for most industries, except Resources. For δ_s, Industrials shows the significant positive coefficients values of 0.003082 at 1% significant level. This implies that exchange rate exposures are positively priced in this period when the cross-sectional analysis is extended on both time and industry perspectives. Whereas Property & Construction and Resources industries show negative delta coefficient values of -0.008370 and -0.003782 respectively. This indicates that excess return over the market return or alpha adversely react to the exchange rate exposure. Thus, when the exchange rate risk increases, investors expecting less risk premium from the additional exchange rate exposure.

Table 14: Overall Tests of Pricing of Exchange Rate Exposure (Monthly data);

Two Factor Model: $\tilde{R}_{it} = [\,\delta_0(1-\beta_i^m) + \delta_s\beta_i^s] + \beta_i^m\tilde{R}_{it}^m + \beta_i^s\tilde{F}_{it}^s + \tilde{\varepsilon}_{it}$

Tests of Pricing of Exchange Rate Exposure. (Without Industry categorizing).

Period	Factors Prices (t-statistics) [P>ltl]				Test of Fit [p-value]
	δ_0		δ_s		χ^2
Feb 2005-Dec 2019	0.0068571	***	0.0003551		0.0214
	(13.23)[0.000]		(0.52)[0.602]		1.0000
Feb 2005-Dec 2007	0.0172101	***	0.0065805	***	0.0635
	(14.35)[0.000]		(8.40)[0.000]		1.0000
Jan 2008 - Dec 2011	0.0086739	***	0.000036		0.0086
	(9.30)[0.000]		(0.06)[0.953]		1.0000
Jan 2012 - Dec 2015	0.0007164		-0.0038263	***	0.0311
	(0.75)[0.455]		(-5.57)[0.000]		1.0000
Jan 2016 - Dec 2019	0.0087	***	-0.0008726		0.0430
	(13.06)[0.000]		(-1.46)[0.144]		1.0000

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table 14 representing overall test of the pricing exchange rate exposure without classifying the stocks into industry, the outcomes show that δ_0 representing the pricing of undiversified exposure can be rejected at 5% significant level in most periods except for January 2012 – December 2015. Whereas δ_s representing the pricing of exchange rate exposure can be rejected at 1% significant level for only two periods of January 2005 – December 2007 (first sub-period) and January 2012 – December 2015 (third sub-period) with the coefficient values of 0.0065805 and -0.0038263 correspondingly. These overall empirical results when not categorized data by industry elaborate that investors in Thai stock market perceive the exchange rate exposure as the risk that hasn't been adequately and effectively hedged by the firms. The investors believe that there are direct and indirect relationship between exchange rate exposure and stock returns left in the market. Hence, for the first sub-period of February 2005 – December 2007 with the significant positive exchange rate risk premium coefficient, when the exchange rate exposure increase, they demand for an increasing in stock returns. Quite the reverse, the significant negative exchange rate risk premium coefficient in the third sub-period (January 2016 – December 2019), implies that industry portfolio's stock returns decrease when the exchange rate exposure increase.

The chi-squared test of fit show that all periods, excess-market exposure and exchange rate exposure are not significantly different at 5% significant level.

The results from our delta analysis advise that majority of the portfolio returns is obtained from idiosyncratic risk. This result corroborates with the modern theory in which the return of the stocks should derive from only the risks that cannot be diversified away. Nonetheless, our empirical evidences indicate that investors in Stock Exchange of Thailand do price the exchange rate exposure as risk premium from time to time.

7. Conclusion

Up until now, numbers of study reveal that the undiversified exchange rate exposures are priced by investors vary across place and time so the conclusion regarding the pricing of exchange rate exposure is still inconclusive. Given that Thailand is an international and continuously growing country, Thai firms in the Stock Exchange of Thailand are prone to be affected by the movements of exchange rate.

Thus, this paper aims to examine the exposure of eight Thai industries in Stock Exchange of Thailand to the exchange rate movement for the period February 2005 – December 2019 by using a panel regression analysis on a two-factor APT model.

Our empirical evidences on cross-sectional analysis on both industry and time perspectives unveiled that stock returns of the property & construction industry adversely reacted to exchange rate movement during the global financial crisis. However, during the last sub-sample periods ranging from 2017-2019, there was direct causal relationship between exchange rate fluctuation and portfolio’s stock returns for Agro & Food, Property & Construction, Industrials and Services industries in SET.

Additionally, the results divulged that investors in Stock Exchange of Thailand significantly expect for a risk premium for the additional exchange rate exposure perceived by them from time to time. This implies insufficient and ineffective hedging on the exchange rate exposure by local companies in the eyes of investors. In a macroeconomic perspective, this can be inferred that Stock Exchange of Thailand and the foreign exchange market do not operate effectively.

However, by nature, the exchange rate exposure is deemed to be able to diversify away. Thus, local firms can diminish the currency risk by accentuating more on hedging through the ownership of risk-offsetting assets or the use of currency derivatives such as currency forwards, futures and options. By doing do, the cost required by investors due to exchange rate risks can be alleviated or even eliminated. Hence, the goal to bring the Stock Exchange of Thailand and the Thai foreign exchange market to be more efficient is absolutely attainable.

APPENDIX

Appendix 1 Summary of numbers of observation used and numbers of firm's alpha and beta coefficients derived from XTRC regression in step 3

Numbers of alpha and beta coefficients from XTRC regression; [Numbers of observation used]	Whole-Sample Period (t = 1-180)	Sub-Sample Periods			
		1st Sub-sample: Period of 2005-2007 (t= 1-36)	2ndSub-sample: Period of 2008-2011 (t= 37-84)	3rd Sub-sample: Period of 2012-2015 (t= 85-132)	4th Sub-sample: period of 2016-2009 (t= 133-180)
Agro & Food Industry	52 [obs.=8,015]	38 [obs.=1291]	45 [obs.=2003]	49 [obs.=2226] Note: 2 obs. drop (Panel too small)	52 [obs.=2493]
Consumer Products	33 [obs.=5,148]	26 [obs.=892]	27 [obs.=1,276] Note: 1 obs. drop (Panel too small)	31 [obs.=1,404] Note: 2 obs. drop (Panel too small)	33 [obs.=1,573]
Financials	53 [obs.=7,941]	37 [obs.=1,276] Note: 1 obs. drop (Panel too small)	42 [obs.=1,908]	51 [obs.=2,220] Note: 2 obs. drop (Panel too small)	53 [obs.=2,534]
Industrials	129 [obs.=20,313]	101 [obs.=3,409]	109 [obs.=5,701] Note: 5 obs. drop (Panel too small)	126 [obs.=5,664]	129 [obs.=6,164]
Property & Construction	118 [obs.=16,951]	78 [obs.=2,651] Note: 2 obs. drop (Panel too small)	87 [obs.=4,044]	106 [obs.=4,643] Note: 3 obs. drop (Panel too small)	118 [obs.=5,608]
Resources	28 [obs.=3,662]	14 [obs.=488] Note: 2 obs. drop (Panel too small)	18 [obs.=820]	26 [obs.=1,040]	28 [obs.=1,312]
Services	102 [obs.=15,698]	78 [obs.=2,769]	82 [obs.=3,885]	94 [obs.=4,182] Note: 7 obs. drop (Panel too small)	102 [obs.=4,855]
Technology	28 [obs.=4,051]	18 [obs.=595]	22 [obs.=992]	26 [obs.=1,142]	28 [obs.=1,322]
Total	543 [obs.=81,779]	390 [obs.=13,371]	390 [obs.=19,999]	390 [obs.=22,521]	543 [obs.=25,861]

The whole panel data has the matrix of (i=543,t=180). This indicates that the whole data consists of 543 firms for 180 sequential months. However, some firms might not have returns data for all the t. Hence, the numbers of firm are different for each time unit as depicted in the following tables.

Appendix 1.1 Summary of the numbers of firm in Agro & Food Industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm (i) that has r_i data in the period	34	34	34	34	34	34	34	34	34	34	34	34	36	36	36	36	36	36	36	36	36	36	36	37	37	37	37	37	37	37
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	38	38	38	38	38	38	38	39	39	39	39	40	40	40	40	40	40	40	40	40	40	40	40	40	41	41	41	41	41	41
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	41	41	42	42	42	42	42	42	43	43	43	44	44	44	44	44	45	45	45	45	45	45	45	45	45	45	45	45	45	45
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	45	45	45	45	45	45	45	45	45	45	45	S45	45	45	46	46	46	46	46	46	46	46	47	47	47	47	47	47	47	48
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	48	48	48	48	48	48	48	49	49	49	50	50	51	51	51	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52

Remark: There are total of 52 firms in the Agro industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 8,015)

Appendix 1.2 Summary of the numbers of firm in Consumer Products industry used for random coefficient regression in the step 3 for each time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	25	25	25	25	25	25	25	25	25	25	26	26	26
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	27	27	27	27
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	28	28	28	28	28	28	28
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	28	28	28	28	28	28	28	28	28	28	28	29	29	29	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	30	30	30	30	30	31	31	31	31	31	32	32	32	32	32	32	32	32	32	32	32	32	32	33	33	33	33	33	33	33
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33

Remark: There are total of 33 firms in the Consumer Product industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 5,148)

Appendix 1.3 Summary of the numbers of firm in Financials Industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	32	32	32	34	34	34	34	34	35	35	35	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	36	37	37	37	37	38	38	38	38	38	38	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	40	40	40
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	42	42	42	42	42	42	42	42	42	42	43	43	43
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	43	43	43	43	43	43	44	44	44	44	44	44	45	45	45	45	46	46	46	46	46	46	46	47	48	48	48	48	48	48
time	12 1	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	48	49	50	51	51	51	51	51	51	51	52	52	52	52	52	52	52	52	52	52	52	52	53	53	53	53	53	53	53	53
time	15 1	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53

Remark: There are total of 53 firms in the Financial industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 7,941)

Appendix 1.4 Summary of the numbers of firm in Industrials Industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	82	83	85	87	88	88	89	90	90	90	90	90	96	96	97	97	97	97	97	97	97	97	97	97	98	98	98	98	99	100
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	100	100	101	101	101	101	101	101	102	102	102	102	103	103	103	103	104	104	104	104	104	105	105	105	105	105	105	106	106	106
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	106	106	106	106	106	106	106	107	107	107	108	108	108	108	108	108	108	108	109	109	109	110	111	111	111	111	111	111	111	112
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	113	113	113	114	115	115	115	115	115	115	115	116	116	116	116	117	117	117	117	117	117	118	120	120	120	121	121	121	121	122
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	122	122	123	123	123	124	124	124	126	126	126	126	127	127	127	127	127	127	127	127	127	127	127	128	128	128	128	128	128	129
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129	129

Remark: There are total of 129 firms in the industrial industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 20,313)

Appendix 1.5 Summary of the numbers of firm in Property & Construction Industry used for random coefficient regression in the step 3 for each time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	67	68	68	68	68	69	70	70	71	71	72	72	73	73	73	73	73	73	73	73	74	74	74	75	78	78	78	78	78	78
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	78	78	78	78	78	80	80	80	80	80	81	81	82	82	82	82	82	82	82	82	82	83	84	84	84	84	85	85	85	85
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	85	85	85	85	85	85	85	85	86	86	86	86	86	86	86	87	87	87	87	87	87	87	87	87	87	87	87	88	88	88
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	88	89	89	89	89	89	91	92	93	93	94	94	94	94	94	95	95	97	98	99	99	99	99	99	100	100	100	100	101	101
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	104	105	105	105	105	105	105	106	106	106	106	109	112	112	112	112	113	113	113	113	113	114	116	117	118	118	118	118	118	118
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118	118

Remark: There are total of 118 firms in the Property & Construction industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 16,951)

Appendix 1.6 Summary of the numbers of firm in Resources industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	14	14	14	14	15	15	15	15	15	15	15	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	17	17	17	17	17	17	17	17	17	17	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	18	18	18	18	18	19	19	19	19	19	19	20	20	21	21	22	22	22	22	22	22	22	22	22	23	23	23	23	24	25
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	25	25	25	25	25	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	28	28
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28

Remark: There are total of 28 firms in the resources industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (No. of observation = 3,662)

Appendix 1.7 Summary of the numbers of firm in Services industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	74	74	74	74	74	74	74	75	75	75	76	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	78	78	78	78	78	78	78	78	78	78	78	78	80	80	80	80	80	80	80	80	80	80	80	80	80	81	82	82	82	82
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	83
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	83	83	83	83	83	83	83	83	83	83	84	84	85	86	86	86	86	87	87	87	87	87	88	88	89	89	90	90	90	91
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	91	91	92	92	92	92	92	94	94	95	97	97	97	98	98	98	98	98	98	99	100	100	100	101	101	101	102	102	102	102
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102

Remark: There are total of 102 firms in the services industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 15,698)

Appendix 1.8 Summary of the numbers of firm in Technology Industry used for random coefficient regression in the step 3 for each individual time unit

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
no of firm(i) that has r_i data in the period	15	15	15	15	15	15	15	15	15	15	15	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18
time	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
no of firm(i) that has r_i data in the period	18	18	18	18	18	18	18	18	18	18	18	19	20	20	20	20	20	20	20	20	20	20	20	20	21	21	21	21	21	21
time	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
no of firm(i) that has r_i data in the period	21	21	21	21	21	21	21	21	21	21	21	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
time	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
no of firm(i) that has r_i data in the period	22	22	22	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	24	24	24	24	24	24	24	24	24	25	25	25
time	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
no of firm(i) that has r_i data in the period	25	25	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	27	27	27	27	27	27	27	27	28	28	28
time	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
no of firm(i) that has r_i data in the period	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28

Remark: There are total of 28 firms in the Technology industry, however, some firms might not have return data for all the t. Hence, the numbers of firm are different for each time unit. (Total No. of observation = 4,051)

Appendix 2 Summary of beta variable numbers in step 4 regression

Numbers of alpha and beta coefficients from Xtrc regression;	Whole-Sample Period (t = 1-180)	Sub-Sample Periods			
		1st Sub-sample: Period of 2005-2007 (t= 1-36)	2ndSub-sample: Period of 2008-2011 (t= 37-84)	3rd Sub-sample: Period of 2012-2015 (t= 85-132)	4th Sub-sample: period of 2016-2009 (t= 133-180)
Agro & Food Industry	52	38	45	49	52
Consumer Products	33	26	27	31	33
Financials	53	37	42	51	53
Industrials	129	101	109	126	129
Property & Construction	118	78	87	106	118
Resources	28	14	18	26	28
Services	102	78	82	94	102
Technology	28	18	22	26	28
Total	543	390	432	509	543

Appendix 3: Descriptive Statistics

Appendix 3.1 Descriptive Statistics by year

Period	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
January 2005 – December 2007	13,376	-0.0363118	0.1218818	-1.235259	2.546766
January 2008 – December 2011	20,005	-0.0188434	0.137226	-2.392384	2.359961
January 2012 – December 2015	22,537	-0.0146118	0.1155806	-1.169707	2.642348
January 2016 – December 2019	25,861	-0.0191405	0.0957768	-4.072227	1.037147
January 2005 – December 2019	81,779	-0.0206284	0.1169177	-4.072227	2.642348

Appendix 3.2 Descriptive Statistics by industry

Industry	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Agro & Food Industry	8,015	-0.0184151	0.1298071	-2.392384	2.195475
Consumer Products	5,148	-0.0223496	0.1076866	-1.235259	0.8120426
Financials	7,941	-0.0207231	0.1026083	-0.9792116	1.014245
Industrials	20,313	-0.0203029	0.1169699	-2.958518	2.642348
Property & Construction	16,951	-0.0227232	0.1233875	-4.072227	2.575421
Resources	3,662	-0.0187885	0.1175284	-0.650642	2.546766
Services	15,698	-0.0206145	0.1156124	-1.206888	2.359961
Technology	4,051	-0.0172174	0.1030823	-0.8890171	1.280642

Appendix 3.3 Descriptive Statistics by year and industry

Period	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
January 2005 – December 2007					
Agro & Food Industry	1,291	-0.0291131	0.1498968	-0.6303581	2.195475
Consumer Products	892	-0.0380777	0.1117801	-1.235259	0.609941
Financials	1,277	-0.0363459	0.094854	-0.7416472	0.5015421
Industrials	3,409	-0.040307	0.1066432	-0.8946232	2.260014
Property & Construction	2,653	-0.0376473	0.1370001	-1.022572	2.545683
Resources	490	-0.0256277	0.1696731	-0.6259558	2.546766
Services	2,769	-0.0354824	0.1163037	-0.7561697	1.730394
Technology	595	-0.0330233	0.1073332	-0.4311527	1.280642
January 2008 – December 2011					
Agro & Food Industry	2,003	-0.01549	0.1463965	-2.392384	0.7729152
Consumer Products	1,277	-0.0184226	0.1256845	-0.8060189	0.8120426
Financials	1,908	-0.0198834	0.1326318	-0.9792116	1.014245
Industrials	5,076	-0.0149024	0.1367034	-1.249565	0.9853223
Property & Construction	4,044	-0.0246486	0.1410799	-1.365834	1.180565

Resources	820	-0.0234968	0.1333118	-0.650642	0.6845101
Services	3,885	-0.0196892	0.1405396	-1.206888	2.359961
Technology	992	-0.0134977	0.1154822	-0.8890171	0.6046892
January 2012 – December 2015					
Agro & Food Industry	2,228	-0.0117565	0.1345064	-0.8404802	1.681305
Consumer Products	1,406	-0.0159991	0.11482	-1.169707	0.7160597
Financials	2,222	-0.0164356	0.096593	-0.5528131	0.8717236
Industrials	5,664	-0.0143202	0.1178512	-0.6371056	2.642348
Property & Construction	4,646	-0.0147849	0.1186819	-1.134645	2.575421
Resources	1,040	-0.0166555	0.1081152	-0.5444489	0.8563386
Services	4,189	-0.0148137	0.1135027	-0.678937	0.9693252
Technology	1,142	-0.0130658	0.0995423	-0.4721991	0.5463732
January 2016 – December 2019					
Agro & Food Industry	2,493	-0.0211761	0.0951675	-0.6987404	0.5102669
Consumer Products	1,573	-0.0222951	0.0780542	-0.5478982	0.5723461
Financials	2,534	-0.0172418	0.0830293	-0.4325732	0.6845205
Industrials	6,164	-0.0191845	0.1018514	-2.958518	1.037147
Property & Construction	5,608	-0.0208511	0.1046998	-4.072227	0.6772957

Resources	1,312	-0.0149822	0.0861339	-0.5237162	0.4515426
Services	4,855	-0.0178802	0.0918019	-0.7919802	0.7171445
Technology	1,322	-0.016481	0.0932521	-0.5836835	0.4676883

Appendix 4 Summary of xtrc commands used in step 3 for random coefficient regression and numbers of alpha and beta coefficients that derived as the regression results.

Pre-determined Period t	Industry	Xtrc commands used to categorize Firm's data R(i,t) into the desired sub-group	Numbers of alpha /beta coefficients derived as results of the random coefficient regression in step 3
Whole-sample period & Agro (time = 1-180)	Agro & Food Industry	Xtrc r_i r_m f_s if time>0&time <=180 & industry == "Agro & Food Industry"	52
Whole-sample period & Agro (time = 1-180)	Consumer Products	Xtrc r_i r_m f_s if time>0&time <=180 & industry == "Consumer Products"	33
Whole-sample period & Agro (time = 1-180)	Financials	Xtrc r_i r_m f_s if time>0&time <=180 & industry == "Financials"	53
Whole-sample period & Agro (time = 1-180)	Industrials	Xtrc r_i r_m f_s if time>0&time <=180 & industry == "Industrials"	129
Whole-sample period & Agro (time = 1-180) Whole-sample period & Agro (time = 1-180)	Property & Construction	Xtrc r_i r_m f_s if time>0&time <=180 & industry == "Property & Construction"	118

Whole-sample period & Agro (time = 1-180)	Resources	Xtrc r_i r_m f_s if time>0&time <=180 & industry == “Resources”	28
Whole-sample period & Agro (time = 1-180)	Services	Xtrc r_i r_m f_s if time>0&time <=180 & industry == “Services”	102
Whole-sample period & Agro (time = 1-180)	Technology	Xtrc r_i r_m f_s if time>0&time <=180 & industry == “Technology”	28
1st Sub-sample period & Agro (time = 1-36)	Agro & Food Industry	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Agro & Food Industry”	38
1st Sub-sample period & Agro (time = 1-36)	Consumer Products	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Consumer Products”	26
1st Sub-sample period & Agro (time = 1-36)	Financials	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Financials”	37
1st Sub-sample period & Agro (time = 1-36)	Industrials	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Industrials”	101
1st Sub-sample period & Agro (time = 1-36)	Property & Construction	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Property & Construction”	78
1st Sub-sample period & Agro (time = 1-36)	Resources	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Resources”	14
1st Sub-sample period & Agro (time = 1-36)	Services	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Services”	78
1st Sub-sample period & Agro (time = 1-36)	Technology	Xtrc r_i r_m f_s if time>0&time <=36 & industry == “Technology”	18
2nd Sub-sample period & Agro (time = 37-84)	Agro & Food Industry	Xtrc r_i r_m f_s if time>36&time <=84 & industry == “Agro & Food Industry”	45
2nd Sub-sample	Consumer Products	Xtrc r_i r_m f_s if	27

period & Agro (time = 37-84)		time>36&time <=84 & industry == "Consumer Products"	
2nd Sub-sample period & Agro (time = 37-84)	Financials	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Financials"	42
2nd Sub-sample period & Agro (time = 37-84)	Industrials	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Industrials"	109
2nd Sub-sample period & Agro (time = 37-84)	Property & Construction	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Property & Construction"	87
2nd Sub-sample period & Agro (time = 37-84)	Resources	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Resources"	18
2nd Sub-sample period & Agro (time = 37-84)	Services	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Services"	82
2nd Sub-sample period & Agro (time = 37-84)	Technology	Xtrc r_i r_m f_s if time>36&time <=84 & industry == "Technology"	22
3rd Sub-sample period & Agro (time = 85-132)	Agro & Food Industry	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Agro & Food Industry"	49
3rd Sub-sample period & Agro (time = 85-132)	Consumer Products	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Consumer Products"	31
3rd Sub-sample period & Agro (time = 85-132)	Financials	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Financials"	51
3rd Sub-sample period & Agro (time = 85-132)	Industrials	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Industrials"	126
3rd Sub-sample period & Agro (time = 85-132)	Property & Construction	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Property & Construction"	106
3rd Sub-sample	Resources	Xtrc r_i r_m f_s if	26

period & Agro (time = 85-132)		time>84&time <=132 & industry == "Resources"	
3rd Sub-sample period & Agro (time = 85-132)	Services	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Services"	94
3rd Sub-sample period & Agro (time = 85-132)	Technology	Xtrc r_i r_m f_s if time>84&time <=132 & industry == "Technology"	26
4th Sub-sample period & Agro (time = 133-180)	Agro & Food Industry	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Agro & Food Industry"	52
4th Sub-sample period & Agro (time = 133-180)	Consumer Products	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Consumer Products"	33
4th Sub-sample period & Agro (time = 133-180)	Financials	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Financials"	129
4th Sub-sample period & Agro (time = 133-180)	Industrials	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Industrials"	118
4th Sub-sample period & Agro (time = 133-180)	Property & Construction	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Property & Construction"	28
4th Sub-sample period & Agro (time = 133-180)	Resources	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Resources"	134
4th Sub-sample period & Agro (time = 133-180)	Services	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Services"	102
4th Sub-sample period & Agro (time = 133-180)	Technology	Xtrc r_i r_m f_s if time>132&time <=180 & industry == "Technology"	28
1st Sub-sample 2005-2007 (time= 1-36)	-	Xtrc r_i r_m f_s if time>0&time <=36	390
2ndSub-sample 2008-2011 (time= 37-84)	-	Xtrc r_i r_m f_s if time>36&time <=84	432

3rd Sub-sample 2012-2015 (time= 85-132)	-	Xtrc r_i r_m f_s if time>84&time <=132	509
4th Sub-sample 2016-2009 (time= 133-180)	-	Xtrc r_i r_m f_s if time>132&time <=180	543

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