PUEY UNGPHAKORN INSTITUTE
FOR ECONOMIC RESEARCH

FX Hedging Behavior among Thai Exporters: A Micro-level Evidence

by

Thethach Chuaprapaisilp, Nathapong Rujiravanich, Bovornrach Saengsith

February 2018

Discussion Paper

No. 81

FX Hedging Behavior among Thai Exporters: A Micro-level Evidence[1]

Thethach Chuaprapaisilp, Nathapong Rujiravanich and Bovornrach Saengsith[2]

1 February 2018

Abstract

Over the past 20 years, Thailand's FX hedging market has evolved to accommodate demands from rising trade and investment activities. Notwithstanding the growth in the use of FX derivative instruments for investment risk management by outward investment funds and non-residents, FX hedging demand from merchandise trade remains a significant part of the market. This paper utilizes a transactional database that disaggregates exporters according to their firm-level characteristics in order to explain their hedging behavior over periods of exchange rate fluctuation. FX hedging by exporters is found to be sensitive to the movement in exchange rate and past hedging experience. These sensitivities give rise to periods of panic or complacency. The effects also vary across exporters with different sizes.

JEL classification: F31, D22, G15

Keywords: Currency hedging, hedging market, hedging behavior

[1] The views expressed are those of the authors and do not necessarily represent those of the Bank of Thailand.

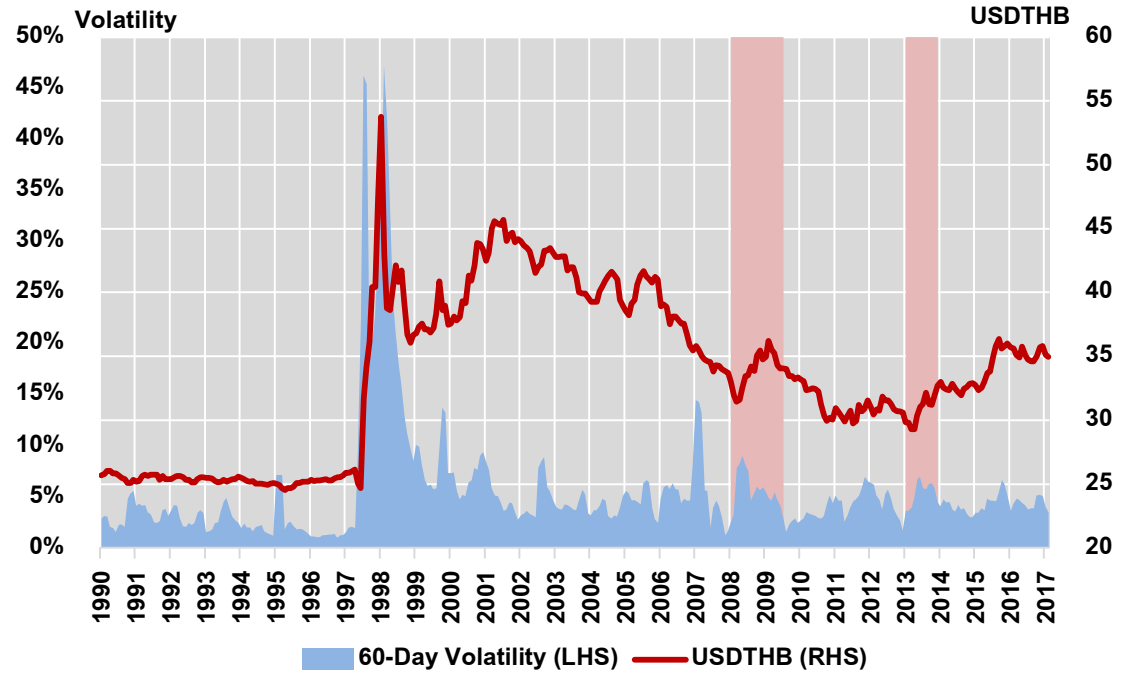
[2] Thethach and Nathapong: Financial Markets Department, Bank of Thailand, ThethacC@bot.or.th, NathapRu@bot.or.th; Bovornrach Saengsith: Data Analytics Unit, Bank of Thailand, BovornrS@bot.or.th. The authors would like to thank our supervisors Roong Mallikamas, Vanaporn Laksanasut, Suchot Piamchol and Nasha Ananchotikul who helped reviewing the drafts and provided valuable suggestions. We are also thankful for the assistance provided by the Data Analytics Unit, Information Technology Department, and Statistics and Data Management Department at the Bank of Thailand and to the participants at the Bank of Thailand FX Research Workshop on 18 July 2017. All errors and omissions are our own.

Table of contents

Introduction

Since the adoption of the 'managed float' exchange rate regime in 1997, the Thai baht (THB), driven primarily by the market mechanism, has become more volatile. External factors including global market sentiments, economic and monetary policies cycles of advanced economies or geopolitical developments have played a crucial role in influencing domestic exchange rate. It is evident that during the Global Financial Crisis in 2008, the taper tantrum in 2013 or subsequently the Chinese financial market turmoil in 2015-16, volatility of the THB became more pronounced. During these periods, volatility edged up to 8-10% comparing to the average of 4-5% in normal times (Figure 1).

Movement of USD/THB — Figure 1



Note: volatility calculated as standard deviation of changes in exchange rate over two-month period
Source: Bank of Thailand

Facing higher volatility, players in the domestic market with FX exposures such as exporters/importers, overseas investment funds, and corporations with foreign currency dominated debts, have been more aware of the FX risks, and have adopted risk management, particularly the use of financial derivatives.

Although hedging volumes have generally increased (as evidenced by Thaicharoen et al.[3] in 2005 and Kohpaiboon[4], in 2010), most hedging transactions were done by larger firms or multinational companies. Most domestic firms that engage in international trade, particularly small and medium-sized enterprises (SMEs), remain unhedged or hedge occasionally, thereby exposing themselves to large FX

[3] Yunyong Thaicharoen, Punpilas Ruangwisut, and Jirapol Mahuttikarn (2005). "Improving Financial Resilience of the Thai Economy against Exchange Rate Risk", Bank of Thailand Symposium, August 2005.
[4] Archanun Kohpaiboon (2010). *Exchange Rate Volatility and Firms' Hedging Behavior: Policy Challenges*, Prince Viwatchai Scholarship Project, 50 Years Bank of Thailand Foundation.

movements. This behavior has at times caused panic hedging during extreme FX movements and adds pressure on the currency. Thus, hedging behavior and its determinants warrant further exploration.

Our discussion in the remaining sections will explore the following issues. Section II elaborates the FX hedging market in Thailand and alternative hedging channels available. Exporters' hedging behavior and determinants are examined in further detail in Section III through exploratory data and regression analysis. The primary focus is on the demand for FX hedging by exporters who are mostly exposed to FX risk associated with USDTHB volatility[5]. Section IV concludes and discusses policy implications from the observed hedging behavior.

II. Overview of FX hedging market in Thailand

In Thailand, the demand for FX hedging varies by market players according to their trade and investment purposes, and involves the use of instruments such as forward contracts, FX swaps, FX options, and cross-currency swaps (CCS). The major instruments for each purpose are summarized in Table 1. More sophisticated instruments such as structured products are also used but their share is still low.

Use of FX hedging instruments by players and purposes Table 1

	Trade	Investment		Borrowing and lending	Funding and liquidity management
		Direct investment	Portfolio investment		
Residents	Forward	Forward Swap	Swap Forward	Forward Swap	
Non-Residents		Forward CCS	Forward Swap		
Financial institutions					Swap

Source: Bank of Thailand

For local participants such as exporters and importers, FX forward is the main instrument for hedging trade exposures, and accounts for 48% of total FX turnover for trade in goods (Table 2). More than half of forward transactions are flexible (or pro-rata) forward types that allow buyers to settle their obligations prior to the maturity date. For exporters, over half of the contracts have maturities longer than three months while many contracts for importers are for less than three months reflecting their corresponding trade credit terms and hedging horizons. Overall, trade in goods account for 52% of all FX transactions by local customers (Figure 2).

For investment-related transactions, demand for hedging by outward foreign investment funds (FIF) serving local investors has also been growing since the allowance for retail investors to invest in foreign assets through local investment funds in 2008 (Figure 3). Non-residents also use FX hedging instruments (forward, CCS and swap contracts) for their investment risk management, both for direct and portfolio investment, whilst financial institutions mainly utilize FX swaps for funding and liquidity management in the interbank market.

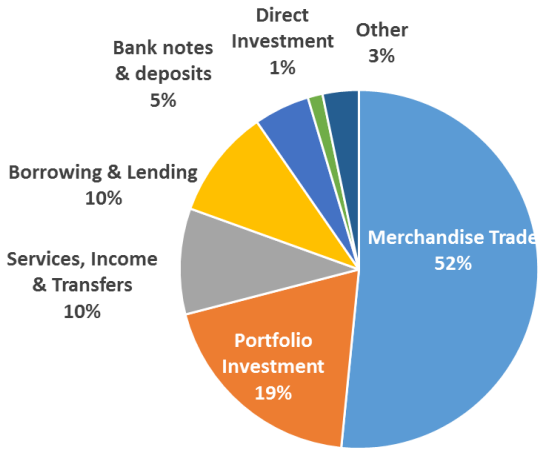
[5] The analysis primarily focuses on exporters. It should be noted that many exporters also have imported content as intermediate inputs, i.e. having some degree of 'natural hedge', which would influence the decision and scope of hedging as well as the sensitivity to exchange rate movements.

FX turnovers by local customers in 2016 (% of total value) Table 2

Purpose	SPOT	FORWARD	SWAP	CCS	OPTIONS	TOTAL
Merchandise Trade	46%	48%	3%	1%	3%	**100%**
Direct Investment	56%	39%	3%	1%	0%	**100%**
Portfolio Investment	16%	25%	58%	2%	0%	**100%**
Borrowing & Lending	27%	28%	33%	11%	1%	**100%**

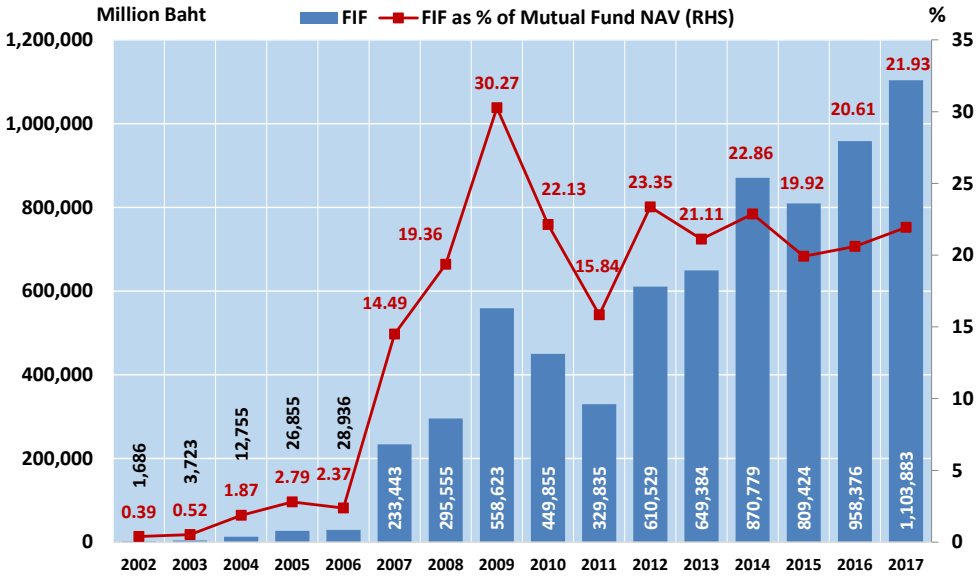
Source: Bank of Thailand

FX turnovers by local customers in 2016 (% by purposes) Figure 2



Source: Bank of Thailand

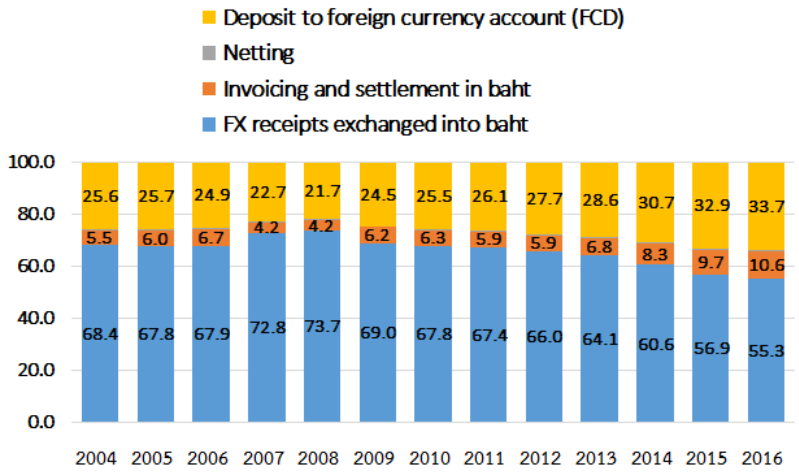
Outward Foreign Investment Fund (FIF) NAV (THB million, and % of Mutual Fund NAV) Figure 3



Source: Thailand Association of Investment Management Companies

In recent years, spot and FX derivative transactions for trade have been on a declining trend. This is due to the fact that exporters turn to utilize alternative channels for FX risk management such as invoicing in the local Thai baht (THB) currency, keeping export receipts in the foreign currency deposit (FCD), or carrying out netting transactions with their FX obligations paid abroad without currency conversion through non-sell/non-deposit (NSND) transactions, or transferring their FX obligations to treasury centers (TC). Figure 4 indicates that the proportion of spot FX transactions has been declining whilst depositing of FX revenues in FCD accounts, as well as invoicing and settlement in Thai baht gains a rising share in the total structure of export receipts.

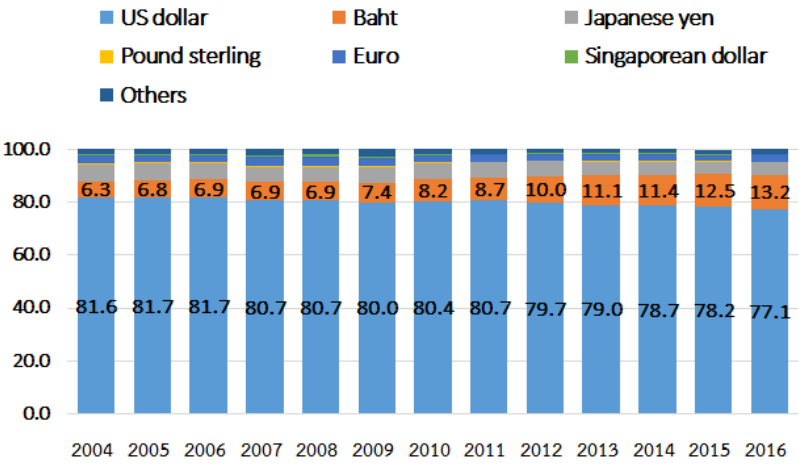
Alternative hedging methods: structure of export receipts (%) Figure 4



Source: Bank of Thailand

Although US dollar remains the dominant settlement currency for Thai exports, the use of Thai baht has been growing continuously (Figure 5) as border trades with neighboring countries in the Greater Mekong Sub-region increasingly gain importance. Settlements in Thai baht make up for 13.2% of total export receipts in 2016, a two-fold increase from 6.3% over the past decade.

Settlement currency of export receipts Figure 5



Source: Bank of Thailand

III. Exporter hedging behavior and determinants

Given the prominence of merchandise trade in FX hedging market as described above, this section focuses on exporters' FX hedging behavior by highlighting related issues in three important aspects: 1) firms' characteristics and hedging behavior, 2) constraints in terms of access to hedging services and transaction costs, and 3) sensitivity to FX movements. At the end of the section we will also provide empirical evidence from 4) a regression that explains firms' hedging level based on the determinants being discussed. The firm level dataset that we use to analyze exporters' hedging behavior comes from three main sources: 1) Financial market statistics reported by commercial banks that include data on FX derivatives transactions, foreign currency deposits and loan utilization, 2) Monthly merchandise trade values obtained from the Thai Customs Department, and 3) Companies financial statistics obtained from the Department of Business Development, Ministry of Commerce. The combined data contain 5,570 exporters that can be classified by size[6] of firms, their use of FX derivatives, transaction amounts, changes in foreign currency deposits, loan utilization rate, net export values, revenues and debt ratio. We use data from the first two sources at monthly frequency for the period 2011-2015. However, firm level data such as firms' total revenues, assets and liabilities (hence debt ratio) from the company registration database are available annually from 2011-2014 only. The discussion in Subsections 1-3 below will therefore include a summary of firms' characteristics and hedging behavior in 2015 using data from the first two sources, whilst the regression results in Subsection 4 will be derived from the combined data on 4,902 firms using variables from all three sources over the 2011-2014 period.

1. Exporters' characteristics and hedging behavior

Several individual firms' characteristics determine the extent to which firms hedge their underlying FX exposure. The **level of hedging** is defined hereafter as ***the proportion of derivatives to total FX transactions in a given month***[7]. The following discussion highlights some key characteristics that are found to determine exporters' hedging level:

- Firm size:
  Large firms tend to hedge more compared with small to medium sized firms. Table 4 shows a sample of regular exporters (with FX transactions in USD) categorized according to size (Small, Medium, and Large) and their hedging levels. Firms' hedging levels are calculated on a monthly basis, and each firm is classified as being 'low', 'medium', 'high', or 'fully' hedged according to the

[6] The analysis includes exporters with reported transactions in US dollars above USD 50,000 for which individual records are available. Firms are classified as being large if their total fixed assets are above THB 200 million (around USD 5.7 million) or employ more than 200 workers. Small firms have total fixed assets of THB 50 million (around USD 1.4 million) or below, or employ less than 50 workers. With this definition, some registered companies are classified as small because they employ few workers but actually have large related operations and export amount. Around 100 out of 2,295 firms classified as small (4-5%) have annual export amount of greater than USD 10 million compared with 300 out of 888 large firms (30%). There are around 10 firms classified as small but have annual exports of over USD 100 million compared with around 70 large firms.

[7] With this definition of hedging level, a firm may appear to be fully hedged even though its true underlying exposure is greater than the total amount of its FX transactions in each month. An alternative measure of hedging level that incorporates firms' exports as their underlying exposure, as opposed to FX transactions alone, should better represent the hedge positions of firms relative to their exposures. Since data on FX transactions and merchandise trade are collected separately, the calculation of the extent of hedging based on true underlying is not as straight forward and requires making certain assumptions such as months of exports that are used to represent the average exposure. An alternative calculation of the hedging ratio based on firms' export values over the length of their hedging contracts produces similar results, albeit with less statistical significance due to occasional jumps in the measure.

median value of its hedging levels (with the upper and lower bounds for each category indicated in bracket and parenthesis next to the table's column headings). For firms in the 'low' category, their median monthly hedging level is below 20%. The corresponding hedging levels are above 20% to 60% for 'medium' category, between 60% and 100% for 'high' category, and 100% for 'fully' hedged category. Firms whose hedging levels are zero in all months, are classified as 'none' (first column).

Exporters with USD transactions in 2015 (% by size and hedging level) Table 4

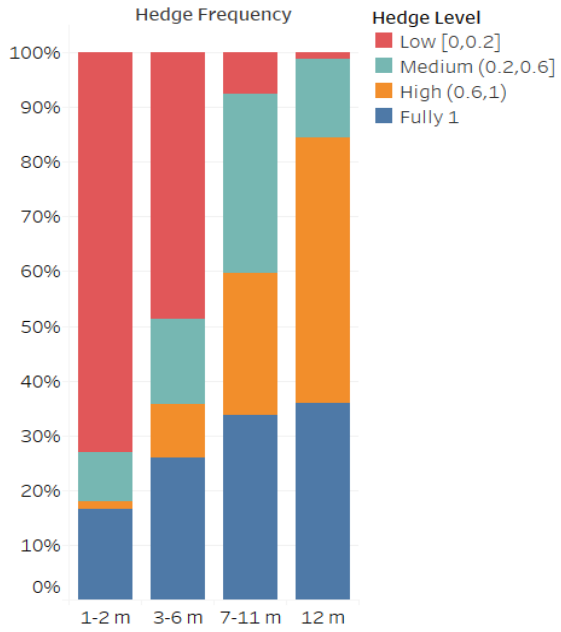
	Hedge Level					
size	None	Low [0,0.2]	Medium (0.2,0.6]	High (0.6,1)	Fully 1	Grand Total
S	72%	13%	6%	5%	5%	100%
M	59%	20%	10%	7%	4%	100%
L	50%	18%	13%	14%	4%	100%
Grand Total	66%	15%	8%	7%	4%	100%

Source: Bank of Thailand

Most small exporters are unhedged (72% of small exporters are in the 'none' category). One plausible explanation is that those SMEs are reluctant to hedge, despite their ability to do so. In addition, they may not be sufficiently informed about FX risk management tools available. However, as discussed in Subsection 2 on constraints to hedging services below, even for other firms that are willing to hedge, some may not be able to obtain credit lines from commercial banks. On the contrary, large firms tend to hedge at a higher degree relative to their exposure: 31% of large firms are in the 'medium' to 'fully' hedged categories compared with 21% and 16% for medium and small sized firms, respectively. Given that large firms tend to have good access to commercial bank credit lines and financial hedging services, they are able to hedge consistently based on their FX risk management policy. For the 50% of large exporters that did not use financial hedging in 2016 (with hedging level in the 'None' category in Table 4), about 10% had also used alternative methods of hedging by exporting in Thai Baht currency and depositing their FX earnings in foreign currency deposits. Most of these firms' export values were below THB 50 million (USD 1.5 million) in 2015. Therefore, their export exposure may not be as large compared with their overall operations.

- Hedge frequency:
  Another aspect of firms' hedging behavior is how frequently they hedge. Figure 6 plots firms at different hedging level against the number of months in a year that they have conducted hedging transactions. Majority of firms which hedge more frequently (conduct hedging transactions in 7-11 months or 12 months in a year as indicated in the horizontal axis) are those with high or fully hedged levels. This provides an indication that firms which are more familiar with hedging as they hedge more often, also hedge more in relation to their FX exposure.

Number of months in a year (2015) that regular exporters conduct hedging transactions (by hedging level) Figure 6



The horizontal axis indicates the number of months in a year (1-2, 3-6,7-11, or 12 months) that firms report hedging with derivatives transactions. The number of firms that corresponds to these hedge frequencies are 485, 581, 540 and 190 firms respectively.

Source: Bank of Thailand

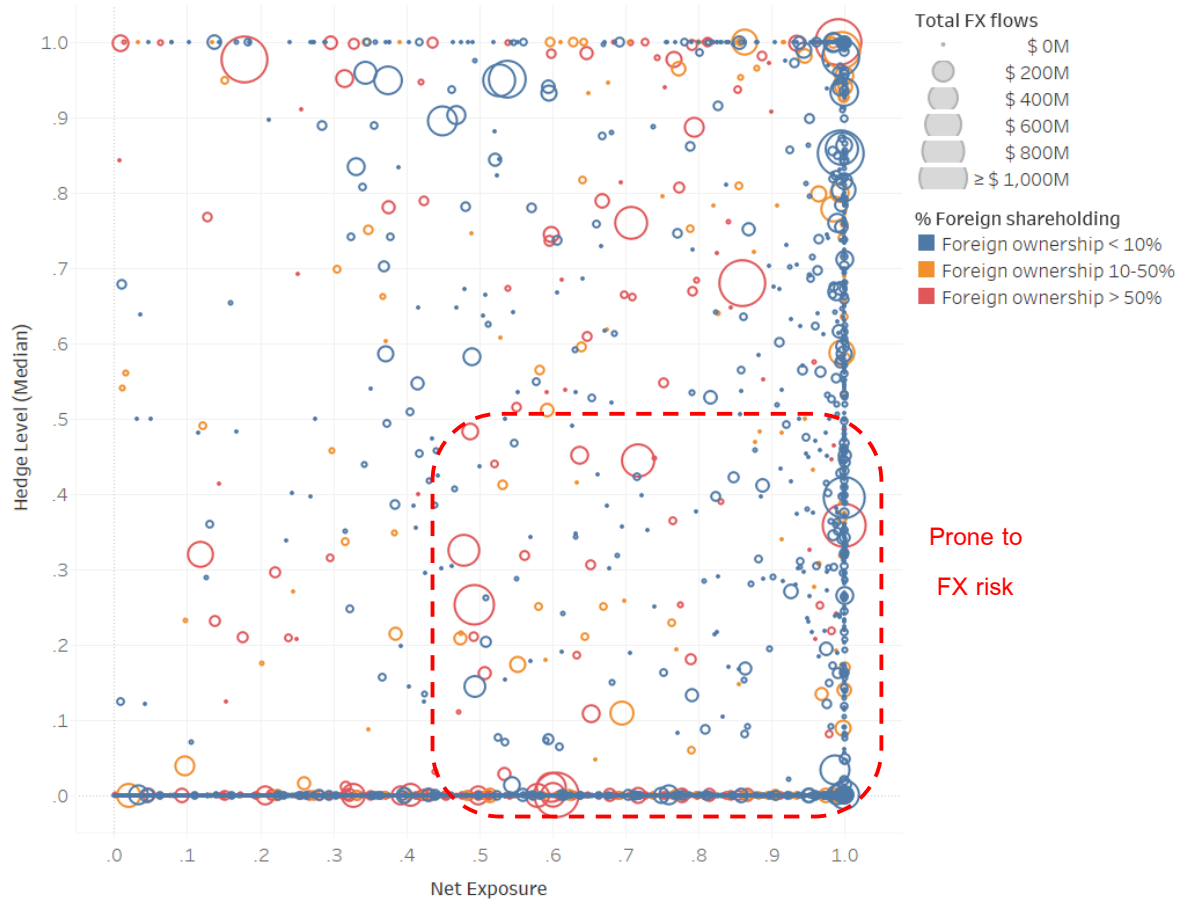
- Natural hedge:
  For many exporters, their *actual* FX exposure may be smaller than their gross exports. This is because many Thai exporters also import intermediate inputs. Therefore, they can reduce their exposure by using export revenues to net out the import costs, i.e. using natural hedge. We try to approximate each exporter's net FX exposure after accounting for natural hedge by using the proportion of its net export over its total merchandise trade value (exports plus imports) in a given year. For each firm with X USD of annual exports and M USD of annual imports, their net exposure is $\frac{X-M}{X+M}$. Exporters that have high net FX exposure, i.e. low natural hedge, are more vulnerable to exchange rate movement.

  Figure 7 plots, for each individual firm, this proxy for exporter's net FX exposure after accounting for **natural hedge** (x-axis) against the **level of financial hedging** (y-axis). The circle size corresponds to their total FX flow (spot and derivatives transactions) associated with merchandise export in 2015. Many firms that are represented by circular bubbles toward the bottom right of the figure (4,033 out of total 5,570 firms) fall into the low natural hedge $\left(\frac{X-M}{X+M} > 0.5\right)$ and low financial hedging level (hedging level < 0.5) category. Incidentally, many of these firms decide to use financial hedging for only a small fraction of their exposure or even leave it totally unhedged. These firms are thus most vulnerable to the volatile FX movement. A majority of these firms are those with none to low hedge levels and without foreign currency deposits (3,849 out of 4,033 firms).

On the contrary, some large firms towards the top left of the figure with low net exposure, also have high hedging level. These firms typically hedge according to their FX risk management policy and therefore hedge a large part of their exposure.

Figure 7 excludes exporters whose total import values are greater than their exports $(X<M)$ in 2015 as well as net importers with most of their FX exposure from import costs. Figure 11 in the Appendix B also plots total export hedging flows for firms with negative net exports. Several large firms with negative net export in 2015 are petroleum companies which import large amount of crude oil.

Hedging level for exporters in 2015 classified by trade exposure and foreign ownership Figure 7



Source: Bank of Thailand

- Degree of foreign ownership:

  Many firms with large FX flows from exports (large bubble size) notably have high degree of foreign ownership. In figure 7, firms with foreign ownership above 10% and 50% are represented by orange and red bubbles respectively. Some large multinational firms are positioned in the medium to high hedge range towards the top of the figure. These firms actively use FX derivatives to hedge their large export earnings. However, there are foreign owned firms that appear to hedge less than 50% of their total FX flows because their FX exposures have been transferred to treasury centers or overseas parental companies that conduct hedging operations on their behalf. Some firms also hold large amounts of foreign currency deposits as an alternative channel to manage their FX exposure.

2. Constraints to hedging services in terms of access and hedging cost

Exporters wishing to hedge their exposure may have limited access to FX hedging if they are credit constrained or consider that transaction costs involved are too high. From the FX hedging transactions we have observed in 2015, all non-financial corporations with FX derivatives transactions have credit lines with their corresponding banks. Banks need to conduct risk assessments of their clients prior to granting credit lines and offering hedging services. Banks report that very small firms without prior banking relationship may not be able to obtain credit line if the banks don't know them well enough or they have no active cash flow. In this light, small- and medium-sized exporters probably encounter more difficulties in obtaining hedging facilities, especially if they are more financially fragile. Likewise, firms that nearly reach their credit limit are less likely to extend hedging utilization or can do so at shorter maturities. Further discussion on the effect of loan utilization on exporters' hedging level is given in Subsection 4 below.

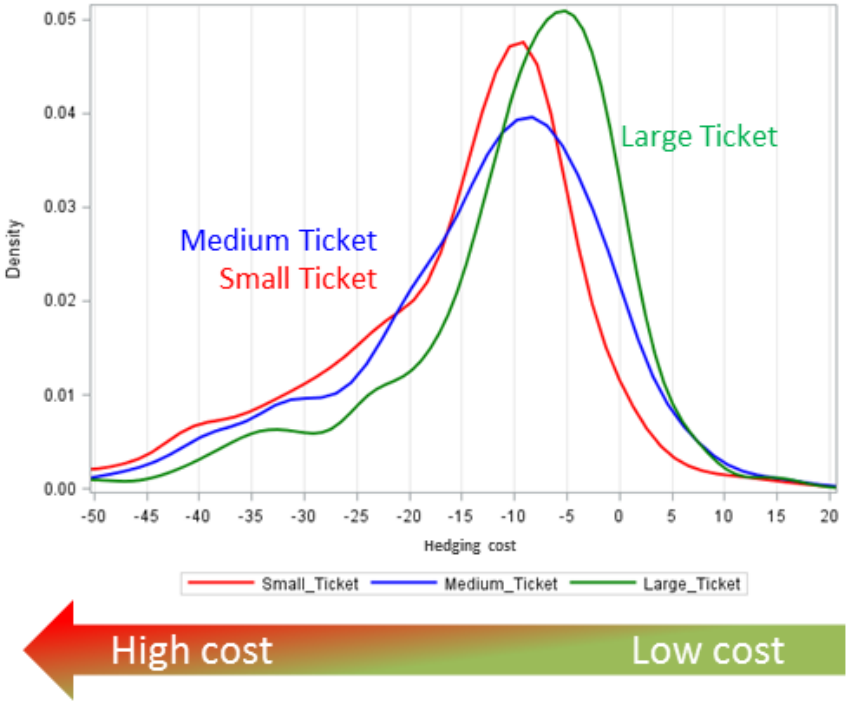
Apart from firm's ability to access bank credit for FX hedging, smaller firms may also face greater hedging transaction cost than larger firms do. Figure 8 shows that the distributions of hedging costs[8] on forward contracts used by exporters with different ticket sizes, are skewed more to the left (more expensive) for contracts with smaller ticket size[9]. Thus, small contracts that are most likely to be used by small exporters generally cost more. This may be because banks face more difficulty in pooling together pieces of small transactions and manage risk inventory. This evidence is only preliminary and remains to be tested, however, since ticket size only serves as a proxy for firm size. In a previous study by the Bank of Thailand[10], the larger forward premium paid by small and medium sized firms cannot be explained by firm size alone, but its determination is influenced by other firms' characteristics such as default risk and their hedging behavior that affect market pricing, especially if their corresponding banks are active players in the market.

[8] Defined as the difference between the forward contract rate and the commercial banks' cost of squaring its position in the interbank market, i.e. the extent that firms get more expensive rates. Cost = forward contract rate – Thai baht reference exchange rate – swap point for the forward contract.

[9] Small ticket size is for transaction amount of less than USD 100,000. Medium ticket size is between USD 100,000 – 1 million and large size is above USD 1 million.

[10] Wanvimol Sawangngoenyuang (2011). "Components of Forward Transaction Cost: Implications for firms' decision to hedge foreign exchange risk", Bank of Thailand Economic Seminar, August 2011.

Distribution of forward contract cost (3-month maturity) for the first 9 months of 2015 Figure 8



Source: Bank of Thailand

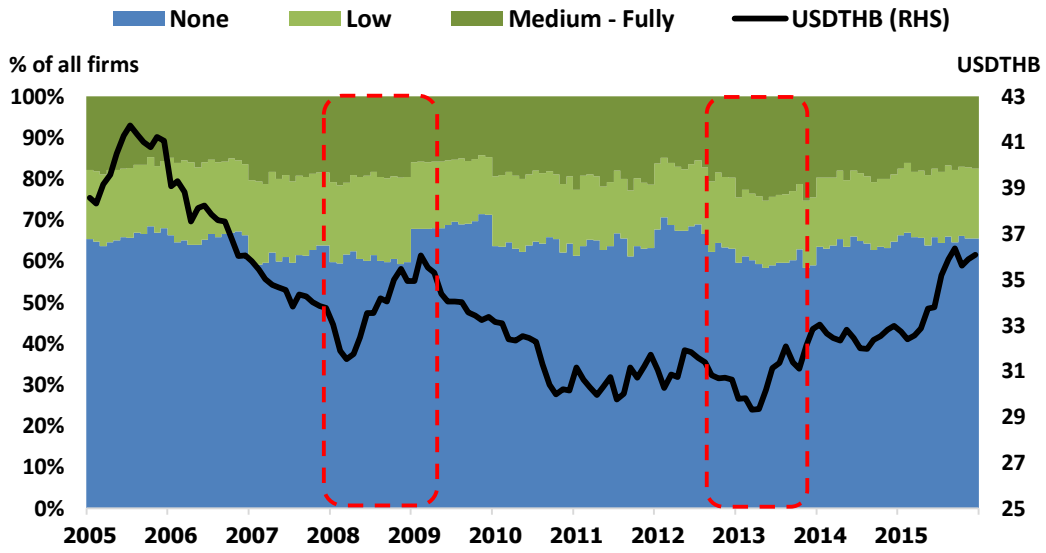
3. Sensitivity to FX movement

Apart from firm characteristics that may affect the extent of FX hedging as discussed above, another factor that undeniably affects exporters' hedging behavior is the exchange rate movement. Large corporations with clearly stated FX risk management policy may hedge the entire amount of their FX obligations or hedge frequently. Their hedging behavior would appear to be not so sensitive to FX movement. For most firms, however, hedging is done less frequently and more opportunistic according to exchange rate movements. Therefore, firms' willingness to hedge largely depends on expected FX movement, both in terms of magnitude and persistence. If the Thai baht currency is likely to weaken just temporarily, exporters may increase hedging to obtain a better rate now than wait for the future. On the other hand, with a persistent Thai baht weakening trend, exporters may defer hedging in hope of a better future rate. For a Thai baht strengthening trend, exporters will increase hedging to avoid getting unfavorable rate in the future.

Figure 9, which plots the hedging distribution of export firms by hedging level over time, shows that firms increased their FX hedging (fewer firms were left in the blue none category) when the exchange rate followed a strengthening path throughout the second half of 2012 to the first four months of 2013. Figure 10 shows the correlation (12 month window) between the USDTHB exchange rate and average hedging level which rises over the periods following sharp Thai baht appreciation trends.

Historical Hedging Level

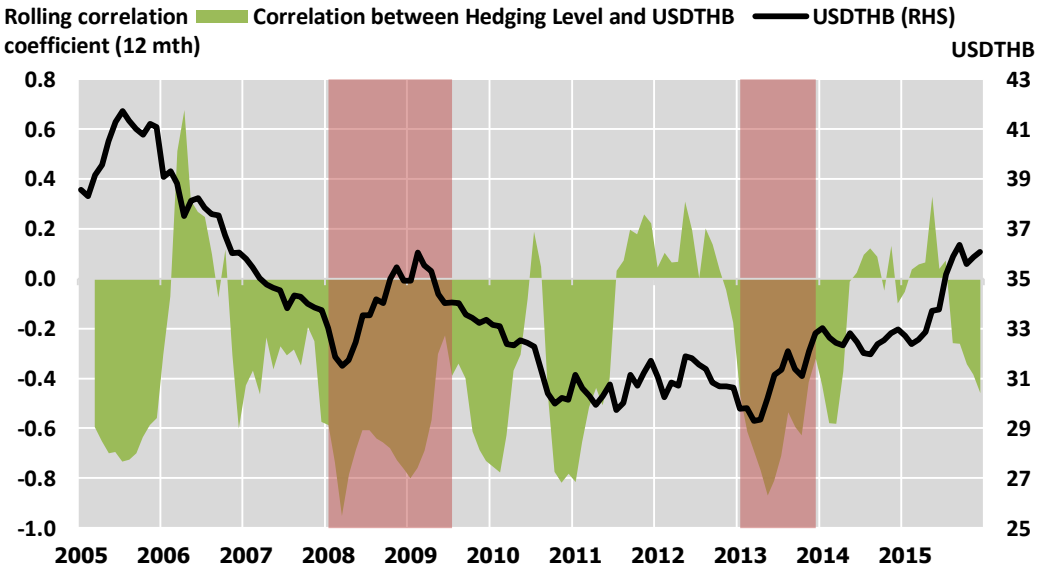
Figure 9



Source: Bank of Thailand

Correlation between average exporter hedging level and USDTHB

Figure 10



Source: Bank of Thailand

4. Regression results

The above discussion points to three main factors affecting the extent of hedging by exporters: firms' specific characteristics including credit constraint, their hedging pattern and the exchange rate movement. To confirm the evidence above, we estimated a panel regression of hedging level on variables representing these factors, using a sample of 4,902 exporters with FX spot and derivatives transactions in US dollars greater than USD 50,000 over the 2011 - 2014 period, as mentioned earlier at the beginning of the section above. Variables that represents firms' characteristics are their export value (**export amount** indicating gross underlying exposure), their net exposure after accounting for natural hedge (**net export exposure**), and loan utilization rate. The **'loan utilization rate > 90% last period'** variable is a dummy variable indicating whether firms have nearly reached their credit limit (over 90% of total credit line utilized) in the preceding month.

Other variables that reflect firms' financial risks and hedging experience are also included[11]. A more financially fragile firm with higher **debt ratio** (total liabilities/total assets) may have incentive to hedge more. Firms may hedge less if they had bad experience with past hedging e.g. the contract exchange rate turned out to be less favorable than the ex post exchange rate at the time of settlement, making accounting losses from hedging. The **loss transaction proportion** variable measures the number of these 'loss making' transactions out of total number FX derivatives transactions made over the preceding 12-month period.

With regards to firms' hedging pattern and experience, if they hedge more frequently and more recently they are likely to hedge more. However, if they hedge less frequently or leave a long lag prior to hedging again they may not have as much hedging skills or lose firm-specific hedging knowledge. Also, if they utilize an alternative hedging channel by depositing more of their FX earnings in FCD accounts, they may reduce their FX hedging as a result. To capture these hedging patterns, the **hedge frequency** variable counts the number of months in which firms conduct hedging transactions as a fraction of the total number of export months within the previous year. The **hedge last** variable equals to 1 over the number of months since a firm last hedged or zero if the firm has never done hedging. Thus, the variable indicates how recently the firm has hedged. The **FCD inflows** variable measures monthly total FX amount deposited into each firm's FCD accounts.

Hedging level is also likely to be sensitive to FX movements and trends as discussed above. Two set of variables are used to capture exchange rate movements and trends in the regression. A variable representing monthly change in FX movement (**FX change %mom**) is used to capture the response in firms' hedging level when the Thai baht exchange rate appreciates or depreciates from month to month. Another set of variables capture FX change after the exchange rate has moved in a certain direction over a period i.e. forming a discernable trend. The **FX strengthening trend** variable measures FX change after the Thai baht has continued to appreciate for 2 months. The **FX weakening trend** variable measures FX change after the Thai baht has continued to depreciate for 2 months. These trend variables are constructed by interacting a dummy variable, indicating whether the exchange rate has moved in a certain direction (appreciate/depreciate) over two months or not, with the corresponding change in monthly exchange rate over the same period.

[11] Most variables included in the regression correspond to those discussed in Richard Fabling and Arthur Grimes (2014). Over the hedge: Do exporters practice selective hedging? Working Paper 14-01, Motu Economic and Public Policy Research.

The regression results (Table 5) show that several variables representing these factors such as firms' export value (gross exposure), loan utilization rate and frequency of hedging, in addition to FX movements, significantly affect firms' hedging level as expected.

The results are mainly consistent across firms' size. The **export value** variable is highly significant for large firms, indicating the importance of the scale of their exposure in determining hedging decision (more exposed firms are likely to hedge a larger proportion of their FX exposure on average) [12].

For the **loan utilization** rate variable, which indicates the availability of further credit line necessary for firms to be able to increase their hedging, our hypothesis is that credit constraint will be more binding for small firms since larger firms will be more able to extend their credit line (having nearly reached the limit of their credit line, small firms will be able to hedge less on average). Thus the estimated coefficient for the dummy variable is more negative in the regression for small firms compared with that for large firms. The estimated coefficients for both groups are not as statistically significant as the overall sample, however, and those for medium sized firms are not significant. By concentrating on loan utilization, our data sample includes only firms which have already obtained the credit lines and other firms have been omitted as a results.

The **proportion of loss making transaction variable** are highly significant across firms' size. On average, firms will reduce the proportion of derivative transactions if they have made more mark-to-market losses on their previous hedging transactions. Firms are thus concerned about the outcome of their hedged positions whether they will make accounting profit or loss on the hedging transactions.

Firms which have hedged more recently (**hedge last** variable reflects hedging experience) is likely to hedge by a larger amount relative to their exposure, indicating the importance of experience with hedging instrument. We also expected that firms with higher frequency of hedging will also hedge a larger amount relative to their exposure. However, it turned out that the coefficient estimates for **hedge frequency** variable are negative and highly significant. This result may reflect the behavior of firms that accumulate their exposure over time and conduct large hedging transactions less frequently, or those firms that rarely hedge but occasionally display panic hedging in response to large change in the exchange rate. This aspect of hedge frequency remains to be explored further. Firms also tend to hedge less if they decide to hold larger amounts of foreign currency deposits (negative estimated coefficient for the **FCD inflow** variable in the regression for the overall sample).

Positive estimated coefficients for both the **FX change** and **FX strengthening trend** variables confirm the positive effects of an expected FX appreciation on hedging. For FX change, during a normal period, when the Thai baht currency is weakened temporarily (an increase in FX change variable i.e. the level of USDTHB), exporters will increase their hedging to lock in the better rate. However, with FX weakening trend, when the Thai baht continues its expected depreciation trend, smaller exporters (with significant negative coefficients on the **FX weakening trend** variable in regressions for firms of size S and M) will reduce their hedging level. With FX strengthening trend, when the Thai baht appreciates significantly over an extended period, exporters will on average increase their hedging.

[12] The standard deviations for the log export value variable for large, medium and small size firms are 2.0, 1.7 and 1.9, respectively. Tables 6-10 in the appendix give a summary statistics for the variables used in the regression.

Estimated marginal effects from panel regression

Table 5

Determinants of FX Hedging by Exporters					
	Panel Fixed Effect Regression	Linear FE	S	M	L
	Average marginal effects (dy/dx) of	Hedge ratio	Hedge ratio	Hedge ratio	Hedge ratio
Firm Characters	**Export amount (in logs)**	0.005***	0.004**	0.005*	0.007***
		(0.00)	(0.00)	(0.00)	(0.00)
	Net export exposure	0.024***	0.017	0.023	0.034***
		(0.01)	(0.02)	(0.02)	(0.01)
	Debt ratio	0.000	-0.004	0.000	0.019
		(0.00)	(0.01)	(0.00)	(0.02)
	Loan utilization rate > 90% last period (Dummy)	-0.028***	-0.039*	-0.024	-0.023*
		(0.01)	(0.02)	(0.01)	(0.01)
Hedging Behavior	**Loss transaction proportion**	-0.235***	-0.269***	-0.213***	-0.223***
		(0.02)	(0.03)	(0.03)	(0.02)
	Hedge Last	0.184***	0.170***	0.164***	0.213***
		(0.01)	(0.02)	(0.01)	(0.02)
	Hedge Frequency	-0.034***	-0.017***	-0.058***	-0.049***
		(0.01)	(0.01)	(0.01)	(0.02)
	FCD inflows	-0.001*	-0.005	0.000	-0.001
		(0.00)	(0.00)	(0.00)	(0.00)
FX Movements	**FX change %mom**	0.010***	0.007***	0.012***	0.011***
		(0.00)	(0.00)	(0.00)	(0.00)
	FX weakening trend	-0.0003***	-0.0004*	-0.0006**	-0.0001
		(0.00)	(0.00)	(0.00)	(0.00)
	FX strengthening trend	0.001***	0.001**	0.001***	0.002***
		(0.00)	(0.00)	(0.00)	(0.00)
	Constant	0.287***	0.312***	0.278***	0.272***
		(0.02)	(0.03)	(0.04)	(0.04)
Number of observations		68,797	24,635	19,546	24,616
Number of groups		4,902	2,543	1,188	1,171
Within R^2		0.06	0.07	0.06	0.07
Between R^2		0.68	0.64	0.69	0.73
Overall R^2		0.53	0.51	0.47	0.56

***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively. Standard errors in parentheses.

Based on a data sample of 4,902 exporters with FX transactions over the 2011 - 2014 period. Number of observations: 68,797 in the regression for all 4,902 firms; 24,635 in the regression for 2,543 small firms; 19,546 in the regression for 1,188 medium sized firms; and 24,616 in the regression for 1,171 large firms.

FX related variables are calculated from data on FX transactions, FCD deposits, and loan utilization that are reported by commercial banks. Monthly merchandise export and import values are obtained from customs statistics. Firms' annual revenue, total assets and liabilities are extracted from companies' financial statistics database.

Linear fixed effect regressions for all firm sizes and for small, medium and large firms separately.

Dependent variable is the ratio of each firm's FX derivatives transaction amount to total FX transaction.

Net export exposure is the proportion of firm's net export over its total trade amount in a given year.

Debt ratio is calculated as firm's total liabililties/total assets in the previous year.

Loss tranasaction proportion is the proportion of FX derivative transactions over the previous 12-month period with accounting loss based on the difference between the contract exchange rate and the actual ex post rate.

Hedge last equals 1/number of months since last hedge, or zero if firm has never done hedging.

Hedge frequency is the number of months with hedging transaction/number of export months within previous 12 months.

FCD inflows is the flow of foreign currency deposits into each firm's FCD accounts in USD million.

FX change is the change in the monthly average USDTHB exchange rate from the previous month.

FX weakening trend is squared FX change over 2 weakening months.

FX strengthening trend is squared FX change over 2 strengthening months.

The *FX weakening trend* and *FX strengthening trend* variables are constructed by interacting a dummy variable, indicating whether the exchange rate has moved in a certain direction (depreciate/appreciate) over two months or not, with the corresponding change in monthly exchange rate over the same period.

Individual (between) fixed effects explain most of the variation in the dependent variable whereas the temporal impact of the independent variables (within fixed effects) are small but significant.

R^2 : within = 0.0647, between = 0.7211, overall = 0.5326.

IV. Conclusion and Policy Implications

The FX hedging market in Thailand has developed to provide risk management service and served as a shock absorber for corporations to withstand volatile FX movements since the adoption of flexible exchange rate regime. The market is dominated by the need of exporters and importers to manage their foreign exchange risks. However, most domestic firms that engage in international trade, particularly small and medium-sized exporters, remain unhedged and expose themselves to large FX movements.

More recently, FX hedging instruments are also employed for investment-related demand by corporations and investment funds (on behalf of individual investors) as they have been allowed greater flexibility to invest in overseas assets. Hedging in Thailand has grown markedly in support of trade, overseas investment, both direct and portfolio investment, as well as FX liabilities management over the past years. Furthermore, hedging instruments become more sophisticated, with structure products gaining more interest from relatively large firms who would like to manage their FX risks more efficiently

Currently, Thai firms have greater access to alternative means of hedging such as the use of foreign currency deposits or local currency invoicing. Nevertheless, the use of financial hedging instruments can be further encouraged by enabling supportive environments in line with our results on exporters' hedging behavior in the following aspects:

1. Improve access to credit line for FX hedging by easing credit and cost constraints through supportive measures, e.g. collateral guarantee scheme for FX derivative contracts by small firms to facilitate contract application and credit line extension.
2. Increase the flexibility of hedging to ease firms' concern about the outcome of their hedged positions by promoting cost saving flexible products such as forward and options that allow firms to avoid incurring large losses from hedging transactions.
3. Encourage discipline hedging through available services and sharing of hedging experience so that firms can avoid costly panic hedging from volatile exchange rate movements.

The authorities would have an important role in the facilitation and provision of necessary infrastructure. This would allow firms to have better ability to access and utilize hedging services more efficiently.

Overall, this analysis of FX hedging behavior still faces several limitations such as the measurement of the extent of hedging relative to the real underlying, the assessment of firms' cost of hedging and how to distinguish firms of different sizes more accurately. In addition, the study can be extended in other directions such as examining hedging behavior across industrial sub-sectors, for example. This would help policymakers formulate an appropriate approach to further develop the FX hedging market.

References

Richard Fabling and Arthur Grimes (2014), Over the hedge: Do exporters practice selective hedging? Working Paper 14-01, Motu Economic and Public Policy Research.

Archanun Kohpaiboon (2010), Exchange Rate Volatility and Firms' Hedging Behavior: Policy Challenges, Prince Viwatchai Scholarship Project, 50 Years Bank of Thailand Foundation.

Wanvimol Sawangngoenyuang (2011), "Components of Forward Transaction Cost: Implications for firms' decision to hedge foreign exchange risk", Bank of Thailand Economic Seminar, August 2011.

Yunyong Thaicharoen, Punpilas Ruangwisut, and Jirapol Mahuttikarn (2005), "Improving Financial Resilience of the Thai Economy against Exchange Rate Risk", Bank of Thailand Symposium, August 2005.

Appendix A

Number of firms — Table 6

Size	Number of firms
S	2,543
M	1,188
L	1,171
Total	**4,902**

Descriptive Statistics (all firm size) — Table 7

	Mean	Std. Dev.	Min	Max
Export amount (in logs)	13.3922	2.0297	-2.6954	20.2328
Net export exposure	0.3023	0.5402	-1.0000	1.0000
Debt ratio	0.6085	1.1190	0.0016	166.7364
Loan utilization rate > 0.9 last period	0.0296	0.1694	0.0000	1.0000
Loss transaction proportion	0.7939	0.2184	0.0059	1.0000
Hedge Last	0.3962	0.4385	0.0000	1.0000
Hedge Frequency	0.8374	0.3531	0.0000	12.0000
FCD inflows (USD million)	0.9142	8.3100	0.0000	481.4364
FX change (%mom)	0.3434	1.7978	-3.3230	4.0738
FX weakening trend	3.9448	8.3330	0.0000	36.7202
FX strengthening trend	1.4336	3.6736	0.0000	22.0073

Descriptive Statistics (small firms) Table 8

	Mean	Std. Dev.	Min	Max
Export amount (in logs)	12.5103	1.8911	-2.6954	20.1582
Net export exposure	0.3212	0.5633	-1.0000	1.0000
Debt ratio	0.6780	1.4133	0.0016	166.7364
Loan utilization rate > 0.9 last period	0.0206	0.1420	0.0000	1.0000
Loss transaction proportion	0.8382	0.2035	0.0297	1.0000
Hedge Last	0.3158	0.4139	0.0000	1.0000
Hedge Frequency	0.8080	0.4537	0.0000	12.0000
FCD inflows (USD million)	0.1233	1.1952	0.0000	53.0215
FX change (%mom)	0.3484	1.8216	-3.3230	4.0738
FX weakening trend	3.7984	8.1670	0.0000	36.7202
FX strengthening trend	1.4776	3.7591	0.0000	22.0073

Descriptive Statistics (medium size firms) Table 9

	Mean	Std. Dev.	Min	Max
Export amount (in logs)	13.1632	1.6854	-0.0544	19.4547
Net export exposure	0.3178	0.5350	-1.0000	1.0000
Debt ratio	0.6065	1.2677	0.0075	63.5834
Loan utilization rate > 0.9 last period	0.0304	0.1718	0.0000	1.0000
Loss transaction proportion	0.8059	0.2095	0.0059	1.0000
Hedge Last	0.3745	0.4255	0.0000	1.0000
Hedge Frequency	0.8346	0.3045	0.0000	12.0000
FCD inflows (USD million)	0.2808	2.2099	0.0000	77.7952
FX change (%mom)	0.3461	1.8014	-3.3230	4.0738
FX weakening trend	3.9396	8.3251	0.0000	36.7202
FX strengthening trend	1.4440	3.6848	0.0000	22.0073

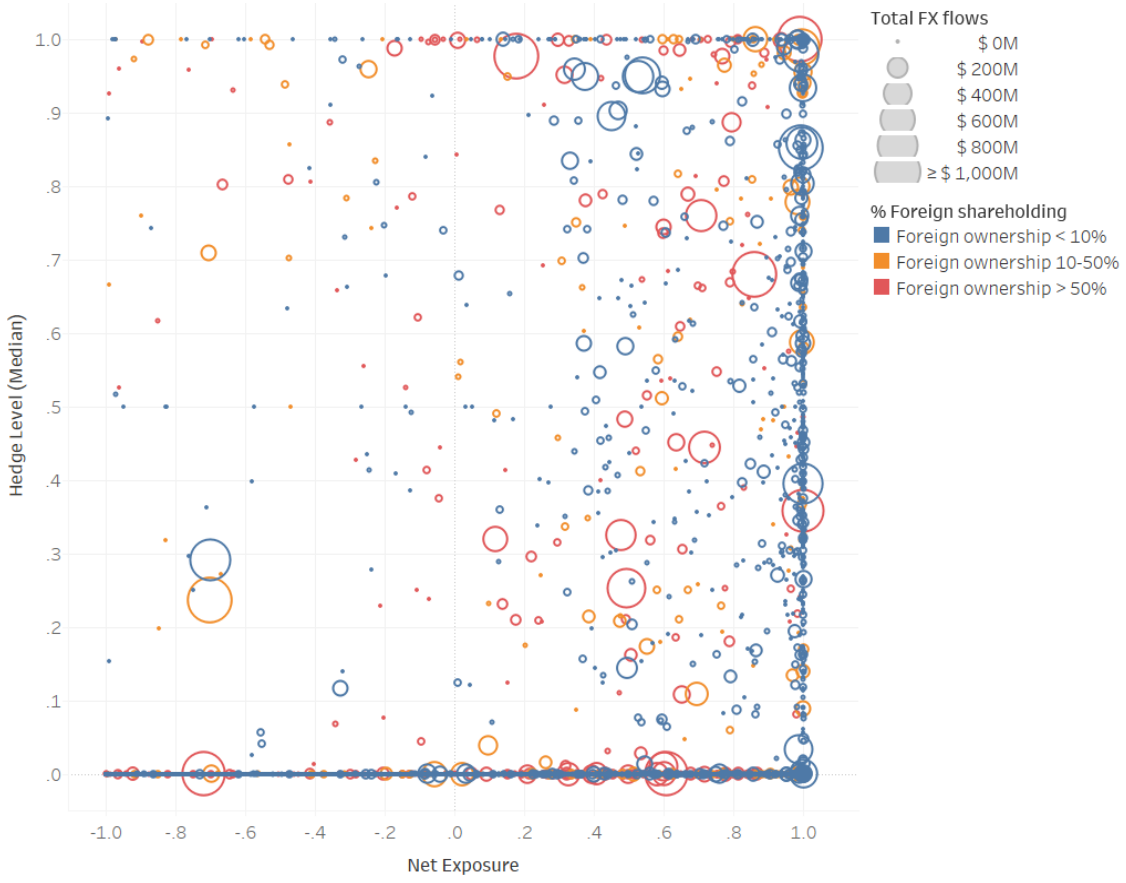
Descriptive Statistics (large firms) Table 10

	Mean	Std. Dev.	Min	Max
Export amount (in logs)	14.3225	1.9843	-0.0314	20.2328
Net export exposure	0.2749	0.5221	-1.0000	1.0000
Debt ratio	0.5404	0.4648	0.0088	13.5842
Loan utilization rate > 0.9 last period	0.0368	0.1882	0.0000	1.0000
Loss transaction proportion	0.7467	0.2277	0.0078	1.0000
Hedge Last	0.4817	0.4531	0.0000	1.0000
Hedge Frequency	0.8648	0.2754	0.0000	12.0000
FCD inflows (USD million)	2.0575	13.1116	0.0000	481.4364
FX change (%mom)	0.3372	1.7743	-3.3230	4.0738
FX weakening trend	4.0756	8.4780	0.0000	36.7202
FX strengthening trend	1.3881	3.5890	0.0000	22.0073

Appendix B

Hedging level for exporters in 2015 classified by trade exposure and foreign ownership

Figure 11



Source: Bank of Thailand