Foreign Currency Risk Management of Thai Corporations: The Use of Foreign Currency Derivatives

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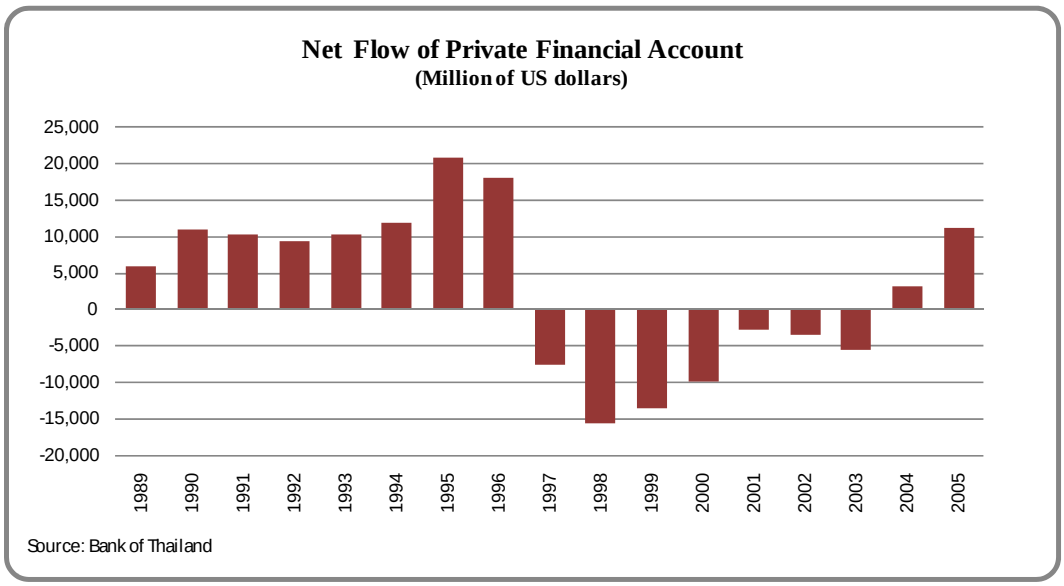
Abstract

This paper examines the important factors that affect Thai non-financial firms' decisions to hedge against foreign currency exposure by using derivatives and further verify the impacts of these factors to the degrees of hedging. The results suggest that Thai firms use foreign currency derivatives, mainly, to reduce expected financial distress and also to mitigate the foreign currency cash flow volatility. The probability of financial distress and the variation of foreign cash flow are the key determinants of firms' decision to hedge and on their level of hedging. In addition, these two factors are also important for Thai firms for their decision to use foreign liability as natural hedging instrument.

1. Introduction

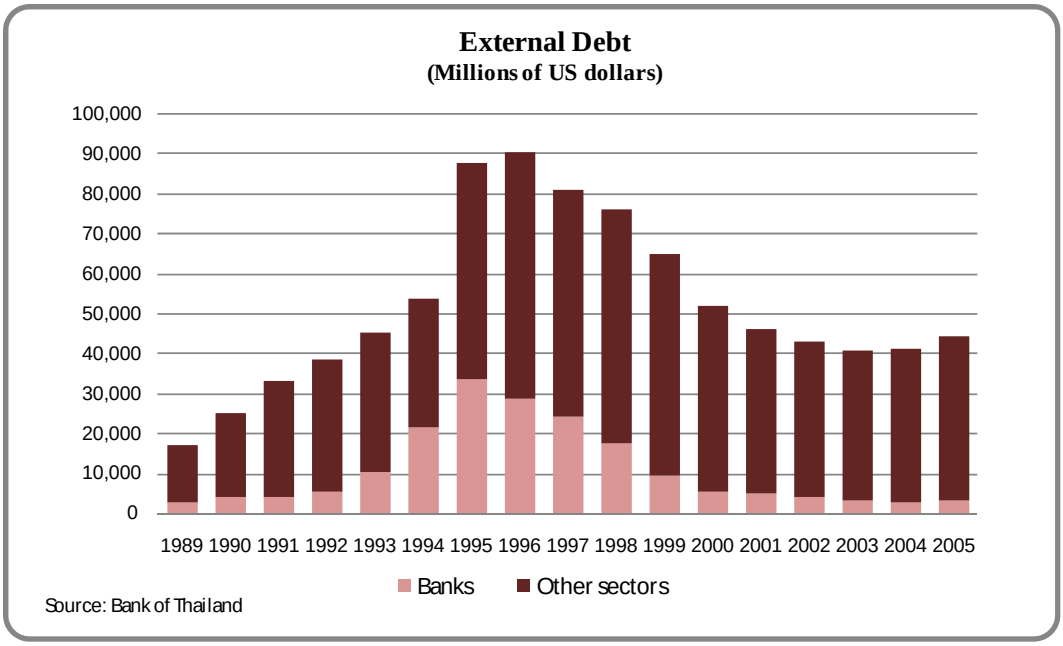
Prior to 1997, Thailand had operated under fixed exchange rate regime. The pegged exchange rate system against a basket of currencies provided a stable financial environment conductive to economic growth. According to the stability of foreign currency in Thailand, import and export firms seemed to have very low risk on foreign currencies. After the liberalization in the early 1990's, the Thai financial institutions and corporations created overwhelming amount of short-term foreign debt and expanded to other areas such as the real estate and construction sectors resulting to an increasing number of new emerging buildings and real estates. Thailand's net capital inflow increased from 5,948 million of USD in 1989 to 10,983 million of USD in 1990, with the highest in 1995 totaling 20,849 million of USD.

Figure 1 : Net Flow of Private Financial Account (Million of US dollars)



With extra short-term foreign debts, there are more mismatching in the corporate balance sheet maturity and currency. Simultaneously, the Baht seem too overvalued under pegged exchange rate regime, around 25.79 baht per USD. This not only lowered Thailand's competitiveness in the world market but also moved us into the huge country trade account deficit.

Figure 2: External Debt (Million of US dollars)



It was recorded that June 30, 1997 was the last day which the Basket-Currencies-System had been imposed in Thailand. The country has defected from fixed exchange rate regime to managed floating rate regime followed by the depreciation of the Baht on July 2, 1997. Consequently, the Baht rallied to 45.29 per USD at the end of 1997 and produced a considerable fluctuation.

With more foreign currency risk management knowledge, the number of Thai firms hedging their risks is constantly increasing related to the growing understanding of derivative instruments. Thai firms tend to use more foreign currency derivatives to mitigate their foreign currency exposures. Figure 2 shows the upward trend of amount of forward position buying and selling in US dollars. From 1998 to 2005, commercial banks increase their total forward positions from 77,528 to 140,149 million of USD. These more forward positions consistent with the extension of Thailand export and import transactions which presents in figure 3.

Figure 3 : Foreign Currency Forward Positions of Commercial Banks (Million of US dollars)

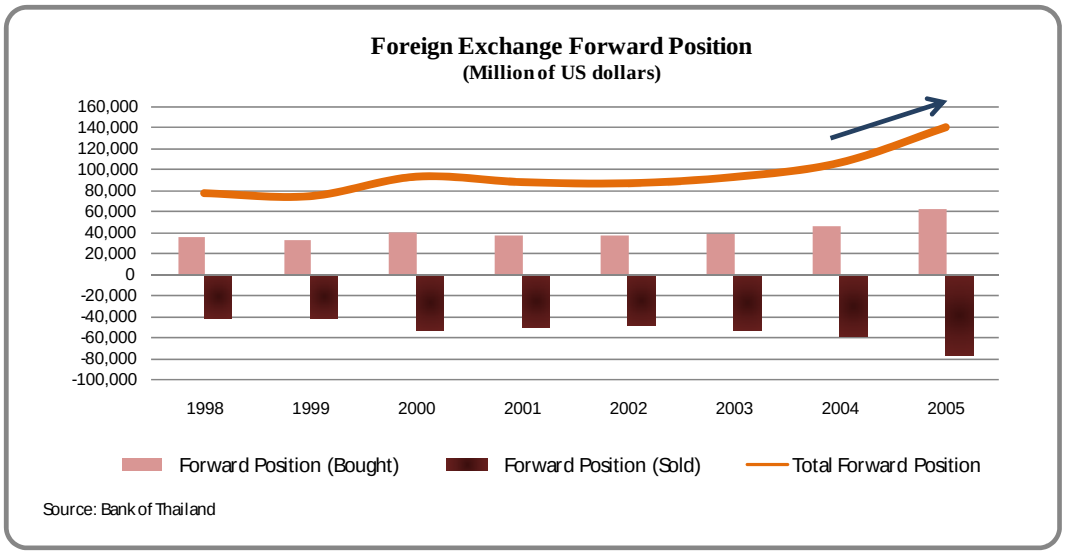
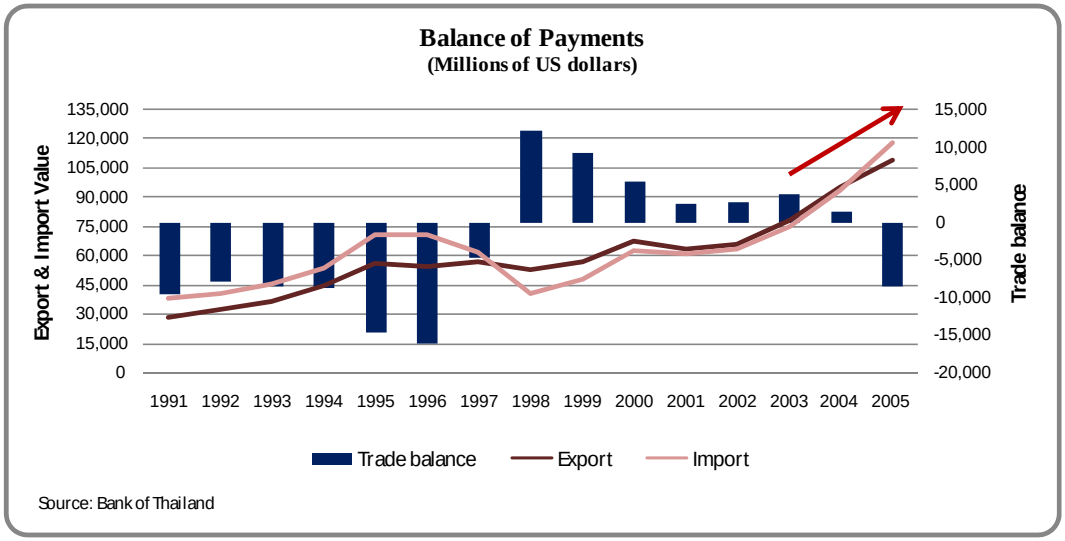


Figure 4 : Balance of Payments (Million of US dollars)



There have been quite wide fluctuations in foreign currency. This means that international firms have to operate their business with greater exposure in foreign currency risk than before. A depreciation of the domestic currency resulted in cheaper exporting goods and also stimulated the growing demand externally. The domestic currency depreciation brought direct benefits to Thai exporters. On the other hand, the appreciation of the domestic currency had added more companies' value to all importers due to their lower cost. Poor management of this foreign currency exposure could have a significant influence on the value of the firms and on their existing. To struggle under such circumstance, many firms had adopted a conservative policy on risk management by implementing a variety of hedging strategies.

Under Modiglianni and Miller theorem (1958), given perfect market assumptions, the corporate financing policy and hedging decision has no impact on the market value of the firm. Investors in the perfect world can be able to hedge or diversify away the risk of their own portfolios because they have the same information and can buy or sell risks in the same manner as the firms do. So firm's hedging by using derivative will not have any impact on their wealth.

However, Smith and Stulz (1985) argue that if all firms allow for the existence of transaction and agency costs in financial markets, hedging would lead to increase the firms' value. For this reason, a variety of theories have been developed regarding to optimal hedging which attempt to explain the reasons firms may be interested in hedging. The hedging decision may be the result of managers' aversion to risk. Nevertheless, other reasons may lead firms to hedging such as decreasing their expected tax, or the transaction costs associated to bankruptcy. Moreover, it is possible to mitigate problems of underinvestment, due to the fact that hedging reduces the volatility of cash flow.

The ability to identify which firms hedge and don't hedge by using foreign currency derivatives and for those that hedge the extent to which they hedge is vital if reliable tests of hedging theories are to be proven. The empirical examination of hedging theories has been hindered by the general unavailability of data on hedging activities. It is only in the last few years that firms have been encouraged to disclose in their note of financial statement and annual report on their hedging policies and their methods of hedging (for example, use of derivatives; forward, future, option and swap). In the absence of this information, most of the earlier empirical studies used survey data to examine the determinants of corporate hedging.

The contribution of this study is the separate analysis of the factors on firms' decision to use foreign currency derivative and their decision of how much to use by using Two-stage framework. In the first stage, using all firms, this study estimates a Logit regression in which the decision to hedge is related to variables that are consistent with optimal hedging theories. In the second test, using only those firms that chose to engage in hedging, this study estimates a Tobit regression using the gross notional amount of foreign currency derivatives to total

assets as a dependent variable. The two-stage framework provides more advantages of information of the firms' decision to hedge and the hedging level. The research objectives are as follows;

1. To identify the main factors of a non-financial firm's decision to use foreign currency derivative
2. To identify the main factors of a non-financial firm's decision on the level of the use of foreign currency derivative
3. To test various models that compares between the implementation of foreign currency derivative and foreign currency liability

This study is important for two main reasons. First, the number of Thai non-financial firms hedging their risks is constantly increasing. This study's dataset contains almost one hundred Thai non-financial firms that hold foreign currency derivatives at the end of fiscal year 2005 compares to 87 non-financial firms at the fiscal year 2000 conducted by Yodpetch (2002). This is the recent year after the firms have encourage to disclose the use of derivative instrument in their note of financial statement and this modernized data might reflect the actual firms' foreign currency risk management. This is better time to understand why firms have the greater attention in hedging especially that, better quality data, needed for the test is more available than the past. Second, this study provides a better understanding of the factors affecting corporate hedging because risk management affects considerably the firm's performance.

The dataset focuses only on Thai non-financial listed companies due to data availability, the full text of financial notes for the extent of derivative recorded. The sample contains 373 Thai non-financial firms listed on the Stock Exchange of Thailand in 2005 and 98 firms held foreign currency derivatives at balance sheet date. This study excludes financial sectors, such as banks, financial institutions and insurance companies because their motivation of using derivatives could be very different from that of non-financial firms. Their businesses involve risk aggregation and diversification so they are likely to hedge against all types of risk. Moreover, they might have special motivation to take certain level of risk under some circumstances such as speculation.

This study is divided into 6 sections. Section 1 begins with the introduction, including of the motivations, objectives and scope of study. Section 2 provides review of literatures. Section 3 explains theoretical framework related to this study. Section 4 describes variable specification, hypothesis and methodology. Section 5 presents the empirical results. Finally, section 6 provides the conclusion of this study.

2. Literature Reviews

This section separates the reviews into 3 parts according to area of study: foreign currency exposure, the determinants of hedging, and hedging strategies. The first part discuss about the determinants of firms' foreign currency exposure. The second part involves indicators that influent the firm's decision and the extent of foreign currency hedging. And the final part examine about the instruments of hedging strategies.

Foreign currency exposure

The market hypothesis (Dornbusch & Fischer ((1980) suggest that changes in foreign currency affect the competitiveness of multinational firms and hence their earnings and stock prices. A depreciation of the local currency makes exporting goods cheaper and may lead to an increase in foreign demand and sales. Consequently, the value of an exporting firm would benefit from a depreciation of its local currency. On the other hand, because of the decrease in foreign demand of an exporting firm's products when the local currency appreciates, the firm's profit will decline and so does its stock price. In contrast, for importing firms the sensitivity of firm value to exchange rate changes is just the opposite. An appreciation (depreciation) of the local currency leads to an increase (decrease) in the firm value of importing firms. Additionally, variations in foreign currency affect a firm's transaction exposure. That is, foreign currency movements affect a firm's future payables (or receivables) denominated in foreign currency. For an exporter, an appreciation of the local currency reduces profits, while a depreciation of the local currency increases profits. Furthermore, foreign currency

movements could affect stock prices because such movements will induce equity flows. Finally, firms can face foreign currency exposure if foreign currency movements affect their input prices, output prices, or the demand of their products.

Allayannis and Ofek (2001) study foreign currency exposures of S&P 500 non-financial firms for 1993. Their model defines the movement of foreign currency as the regression coefficient of the firm value measured by the firm's stock price on the foreign currency movement and assume that foreign currency are exogenous. They estimate each firm's foreign currency exposure by using monthly stock return data to eliminate the noise problem that may be occur if use daily or weekly data. The results show that the importers will hurt measure by decreasing in stock returns when the foreign currency depreciate (negative relationship) on the other hand, the exporters will have benefit (positive relationship). Moreover, they conclude that the firm's foreign currency exposure is come from the firm's real operations through the foreign sales.

Dominguez and Tesar (2006) examine the relationship between foreign currency movement and firm value. They test for the presence of foreign currency exposure in a sample of eight (non-US) industrialized and developing countries over 1980-1999. They find that the profitability defined by stock returns have a statistically significant relationship with the foreign currency. To investigate the factor of that exposure, they run the regression between the firms' exposure on the firm- and industry-specific characteristics. The results show that the small and medium size firms scaled by the capitalization are more likely to be effected by the currency movement with one rationale that the large firms have more information and ability to access the foreign currency hedging than the small and medium size firms. Moreover, they find that the firms which have international activities through the foreign sales, international assets have the more likelihood of foreign currency exposure.

Chatsangar (2004) studied about the effects of foreign currency exposure on Thai firms' value and the determinants of foreign currency exposure. She use panel data model and conclude that the foreign currency movement weakly explains changes in firms' value. She divides the determinants of foreign

currency exposure into 5 main groups. These determinants include the degree of foreign involvement, economies of scale in hedging cost, liquidity, leverage, and growth opportunity. To investigate the determinants of the foreign currency exposure, she uses the several methods such as Ordinary Least Square, Weighted Least Square, and Tobit regression. The empirical results show that firm size is the significant determinant on the foreign currency exposure. Large firm might have not only the economic of scale but also have the more information of using derivative therefore firm size and foreign currency exposure should have the negative significant sign.

The determinants of hedging

Under the classical Modigliani and Miller (1958) theory, financial derivative contracts can not influence firm value. Assuming perfect capital markets, the classical MM theory implies that firms have no reasons to engage in hedging activities whereas shareholders of the company who wish to mitigate their risk exposures always have the possibility to perform the necessary hedging transactions on their own. Many empirical studies examine the determinants of corporate hedging and identify how to measure these determinants. There is a consensus in the financial world that imperfections in financial markets are responsible for the existence of incentives to hedge with derivatives.

It is only in the last few years that firms have been encouraged to disclose in their annual reports information on their hedging policies and their methods of hedging. In the absence of this information, most of the earlier empirical studies use survey data to examine the determinants of corporate hedging. Nance et al. (1993) use the survey data on Fortune 500 firms and find that firms which have more convex tax functions, have less coverage of obligations, large size, and have more opportunity of growth tend to use derivative for hedging. Further improvements in the quality of annual report disclosures have made it possible for recent studies to employ quantitative data on derivative usage to measure the extent of hedging.

Fok, Carroll and Chiou (1997) study the determinants of corporate hedging by using the off-balance sheet instruments (e.g. forward, future, swap and options)

and their impact on the firm value. They measure the diversification, the tax convexity, the probability of financial distress, firm size, the agency cost, and the multinational corporation activity as the group of explanatory variables. They estimate this model by using Logit regression, the dependent equal to 1 if the firm hedged, and 0 otherwise. The coefficients of six from seventeen variables are significant such as firm value, times-interest-earned ratio, R&D expenses, book-to-market ratio, the multinational dummy variable, and the managerial ownership. They conclude that hedging can increase the firm value by reducing the agency cost and financial distress while the tax convexity function is not support the hypothesis.

Allayannis and Ofek (2001) use the two-stage process to separately analyze the significant determinants of firms' decision to hedge and their decision on the level of hedging. They use unique data of S&P 500 non-financial firms for 1993. The explanatory variables are the proxy of optimal hedging theory. In the first stage, the dependent variable is dummy variable of foreign currency derivative use. For the second stage, dependent variable is the amount of foreign currency derivative scaled by total asset. They find that firm's exposures through foreign sales and foreign trades are very important factors that both prompt corporations to hedge and guide their decision on how much to hedge.

For the determinants of foreign currency hedging of UK non-financial firms, Judge (2002) indicates that foreign currency hedger is the foreign currency derivative user who uses derivative for hedging activity not for speculation and defines the characteristic of foreign currency exposures in term of foreign sales, foreign tax, and import or export activities in annual report. This study uses Logit regression to analyze the determinants of using derivatives and finds that the firm liquidity, foreign currency exposures and firm size provide incentive to hedging.

Yodpetch (2002) also uses the Logit regression to identify the determinants of corporate hedging. She uses the 274 observations of Thai non-financial listed firms for 2000. The empirical test finds that the investment tax credit, foreign liability and firm size are the significant determinants of hedging for Thai non-financial firms.

According to financial theory and empirical evidence, Luis, Alfonso, Sara and Milagros (2005) state that the reasons which explain hedging with derivatives are related to the creation of value, information asymmetry, managers' risk aversion, economies of scale and the degree of risk taken on. Specifically, the creation of value associated to hedging with derivatives derives mainly from a reduction in agency and bankruptcy costs, as well as from making the most of tax advantages. Hedging also responds to other factors such as the protection of managers' wealth, the degree of risk taken on, and the cost of hedging. Their results are consistent with the theoretical arguments, which indicate that firm hedges in order to increase the firm's value by reducing the agency cost of bankruptcy.

Singh and Upneja (2006) study the extent of hedging of US lodging firms over 2000-2004. They suggest that it should be use the separate analysis model, two-stage process, to indicate which determinants influent hedging decision. And this study shows financial leverage and firm size are significant factors on probability of hedging and the amount of hedging.

Most of the empirical studies use the Logit regression to investigate the relationship between the use of foreign currency derivatives and the proxy variables of optimal hedging. Almost results conclude that the expected financial distress cost and firm size might lead the likelihood of firms' hedging decision.

Hedging strategies

Firms make extensive use of foreign currency derivatives and other hedging instruments to protect themselves from unexpected movements of foreign currency. It should be no any effect of foreign currency movements on firms' value when firms use foreign currency derivatives. However, derivatives can also be used for speculative purposes. This creates a genuine concern for investors and regulators as to what role derivatives play in a corporation.

Allayannis and Ofek (2001) study the use of foreign currency derivative purposes compared between hedging and speculation of a sample of 378 U.S. non-financial firms. They examine the effect of foreign currency derivatives use on

firms' foreign currency exposures measured as the sensitivity of the stock returns, to an unanticipated change in a foreign currency. By using the two stage regression, they find firms' foreign currency exposure is positively related to their ratio of foreign sales to total sales, and negatively related to the ratio of foreign currency derivatives to total asset. They also find the same results on the use of foreign currency debt that imply firms use foreign currency derivatives and foreign currency debt for hedging not for speculation purpose.

Judge (2003) examines whether foreign currency derivatives and foreign currency debt are complements or substitutes in hedging foreign currency exposure. The multivariate logistic regression model shows significant results that firms engaged in exporting prefer the use foreign currency derivatives to the use of foreign currency debt. Moreover, the results show that foreign currency derivatives and foreign currency debt are complementary rather than substituting strategies for managing foreign currency exposure.

3. Theoretical Framework

Neo-classical framework of Modigliani and Miller (1958)

Financial theory states that the market value of a firm is determined by its earning power and the risk of its underlying assets, and is independent of the way it chooses to finance its investments or distribute dividends. A firm can choose between three methods of financing: spending profits, borrowing or issuing shares. In a perfect capital market, Modigliani and Miller (1958) showed that financial policies of the firm are irrelevant because the shareholder can create or undo whatever financial decisions the firm has made. As a consequence, the shareholders should not favor the decision to hedge against foreign currency risk since they can select well-diversified portfolios to rid themselves of firm specific risk. Moreover, the firm values will independent of the financial gearing it employs as long as investor can borrow and lend on the same terms as firms. Because there are no tax and transaction cost, It makes no difference whether a firm finances itself with debt or equity. Therefore, M&M Capital Structuring

Theorem states that the market value of a firm is independent of the way it chooses to finance its investment.

The major perfect market assumptions are as follows:

1. There are no taxes.
2. There are no transaction costs.
3. There are no bankruptcy costs or financial distress costs.
4. There are no informational differences among market participants.
5. Individual market participants have no impact on markets.
6. Markets have no unlimited capacity to supply fairly priced and debt equity to the capital markets.

Corporate risk management theory

In the absence of market imperfections, no financial derivative contracts can influent the firm value. Modigliani and Miller (1958) implied that firms have no reason to engage in hedging activities whereas shareholders always have the ability to perform the necessary hedging transaction by themselves. In fact however, capital markets are imperfect and these imperfections can be broadly summarized as costly external financing, taxes, agency costs and financial distress costs. Many studies identified the reasons why firms use derivative to hedge the foreign currency risk**.**

Corporate Tax Structure

If a firm faces a convex corporate tax function then hedging can reduce the firm's expected tax liability. The tax benefits from hedging will be generally greater as the convexity of the tax function increases. Firms with more of the range of their pretax income in the progressive region of the tax schedule have greater tax based incentives to hedge. Smith and Stulz (1985) prove that if a firm's tax curve is convex, hedging would increase firm value by reducing tax paid. The more convex of the effective tax function is the greater reduction in the firm's

expected tax liability from hedging. This implies the greater the convexity gives the greater incentive to hedge. The factor that cause convexity in the tax function is the progressive in the statutory tax code which firms with more of the range of their income in the progressive region of the tax schedule have more tax based incentive to hedge. Tax loss carry forwards, investment tax credits, and foreign tax credits are also the causes of tax convexity function. Tax loss carry forward decreases the tax liability because profits in one year can be offset by losses in another year. Because of these tax preferences, firm needs to take a full more advantage of its tax preferences to minimize its taxes through reducing the variability of pre-tax income by using derivatives. Reducing variance through hedging increases the expected value of tax benefit because the probability of using tax preferences increase with the level of a firm' s taxable income. Firms with more tax preferences have the greater incentive to hedging.

Expected Costs of Financial Distress

The transaction costs of financial distress can lead firms to hedge financial price risks since the probability of incurring the costs is reduced. The savings in expected costs will vary directly with the probability of financial distress if the firm does not hedge and with the costs of financial distress. Financial distress cost can be separated into direct and indirect cost. Direct costs consist of the legal fees, management's labor spent on the bankruptcy procedure and indirect cost are the cost of all kind of implicit loss due to the possibility of financial distress such as lost market share or firm's competitiveness. The probability of financial distress is the higher ratio of firm's fixed obligation such as debt relative to it cash flows, and the volatile of cash flow is also lead firm to face the financial distress. Therefore, firm which high direct and indirect financial cost will have more probability of financial distress and tend to have more incentive to use derivative for hedging.

Costs of underinvestment: Firm growth opportunities

According to Myer (1977), shareholders of firms which are likely to go bankrupt are no incentive to contribute new fund to invest in new positive NPV projects. The reason is shareholders bear the entire cost of these projects while the returns go to the debtholders. To protect themselves, shareholders have no invest in any project. This is called the underinvestment problem. The cost of underinvestment will be greater for the firms with more growth investment opportunity. Hedging can reduce the incentive of underinvestment by reducing the fluctuation of investment outcomes then the firm value will increase. Because firms with more future growth opportunities are more likely to face the underinvestment problem so they are more likely to use the foreign currency derivatives.

Source of cash flow volatility: Foreign currency exposure

Firm involves in the international transaction through the export sale, foreign income, foreign asset, foreign investment, and foreign debt might have more foreign currency exposures and it will have more risk with the volatility of these cash flows. To reduce the volatility, this kind of firm has more likelihood to hedge by financial instruments or natural hedge to match maturity and currency of cash flow. Hedging theories identify the need to reduce risk by highlighting which factors make cash flow or income volatility costly. Furthermore, the analysis recognizes that the more volatile cash flows are the more costly these factors become. It follows from this that the need to reduce risk also depends on the level of cash flow volatility faced by the firm. Therefore, firms with more volatile operating income are more likely to hedge to reduce risk.

Hedging substitutes

Many studies consider the existence of alternative methods of risk management on the decision to hedge with derivatives. Not only using the derivatives to reduce the volatility of cash flow, firm also manage the risk by reducing the cost of financial distress with the firm' s liquidity. Firms can reduce

the financial distress cost by investing in more liquidity assets because with their short term maturity, the debtholders can sure that fund will not default and pay fixed claims. This liquidity can be measure by current ratio and quick ratio. Muller (2005) study show that firm which liquidity constrain may have more incentive to use derivative to mitigate the probability of financial distress.

Transaction cost: Economies of scale

Firm size has no specific relationship to the incentive of derivative using. The positive relationship between firm size and hedging can interpret that the large firm has the benefit from the economic of scale and tend to have more information about the use of derivative. However, firm size and the use of derivative can be the negative relation because the small firms have greater financing cost than the large firms which are likely to finance external funding so they will face more financial distress that incentive them to hedge. Therefore, firm size can have the positive or negative relationship with the use of derivative.

4. Methodology

A firm can employ its foreign currency hedging decision in one step, deciding whether or not to hedge and how much to hedge; or in two steps, deciding how much to hedge only after it has decided to hedge. Recent studies have employed a continuous measure of hedging in an attempt to examine the determinants of the decision of how much to hedge in one step. This methodology effectively sees these two decisions, the decision to hedge and the decision how much to hedge, as being linked.

However, the influence of a specific variable on the decision by a firm to hedge could differ from the influence of the same variable on the level of hedging by those firms that have decided to hedge. Therefore, a limitation of the one step model is that it does not allow the possibility that the relation between characteristics of a firm and the probability it decides to hedge is different from their relation to the level of hedging, if it enters to hedging. To eliminate this limitation, the previous studies use the two-stage framework.

The two-stage framework applies when the probability of the decision to hedge is determined separately from the level of the fraction of exposure to hedge. This model is a combination of a Logit Regression (the decision equation) and a Tobit Regression (the regression equation for non-zero outcomes). These regressions have the same group of proxy independent variables based on the theory of hedging which are corporate tax structure, the expected cost of financial distress, costs of underinvestment, source of cash flow volatility, hedging substitutes, and transaction cost.

Hypothesis Specification

I would check the impact and correlation of the factors including corporate tax structure, the expected financial cost, the underinvestment cost, the foreign currency exposure, the hedging substitute and transaction cost on the firm's decision to use and the level of using foreign currency derivatives. Each variable will be represented by proxy, which is explained later on. This study tests the proxy variables through these hypotheses as follows:

$H_0$1: The use of foreign currency derivative would expect to be a positive correlation to the corporate tax structure

$H_0$2: The use of foreign currency derivative would expect to be a positive correlation to the expected cost of financial distress

$H_0$3: The use of foreign currency derivative would expect to be a positive correlation to the underinvestment cost

$H_0$4: The use of foreign currency derivative would expect to be a positive correlation to the foreign currency exposure

$H_0$5: The use of foreign currency derivative would expect to be a negative correlation to the hedging substitute

$H_0$6: The use of foreign currency derivative would expect to be a positive or negative correlation to the transaction cost of using derivative

Variables specification

Measuring foreign currency derivative

The most common approach to measure corporate hedging consists in a dummy variable indicating whether the firm uses derivatives. Allayannis and Ofek (2001) define derivative usage as the holding of foreign currency derivatives. A dummy variable is a very attractive measure for corporate risk management activities because it is very simple to construct but it has the limit. The limit is dummy variable only present the information of the decision to hedge, it does not provide the quantitative information about the level of hedging. Therefore, it does not guarantee that factors explaining such decision of hedging are also significant factors of hedging extent.

To measure the variable of level of foreign currency hedging, Allayannis and Ofek (2001) propose the gross notional value of foreign currency derivative contracts held by non-trading proposes scaled by the firm's size as a measure for corporate hedging. The advantage of the gross notional value over the dummy variable is the quantitative information about the level of derivative usage. This makes tests of hypothesis on the determinants of the amount of foreign currency derivative employed to hedge.

This study constructs a binary variable to examine the decision of hedging. Firms that hold foreign currency derivatives for non-hedging purposes (FCD) are assigned the value of one for the binary choice, and zero otherwise. Measuring the amount of foreign currency derivative, this study gathers total gross notional values for foreign currency derivative held by each firm for non-trading purpose scaled by total asset (FCD_TA)

Foreign currency derivative usage can be measured as the hedging activity because firms are required to disclose state if they speculate with derivatives. Many firms provide statements such as "The Company and its subsidiaries do not hold or issue derivative instruments for speculative or trading purposes". Nevertheless, none of the observations state that they speculate. Additional, variables are defined using only those foreign currency derivatives disclosed for non-trading purposes. Therefore, this study categorizes firms that use foreign

currency derivatives for non-trading purpose as hedgers and those that do not use foreign currency derivatives for non-trading as non-hedgers.

Firms only disclose the amount of outstanding derivatives not the entire amount they used during the year. Therefore, this variable has some limit when firms which use foreign currency derivative during the year might have no outstanding position at the end of year and there are no information of the derivative transactions. With this limitation, therefore, this study indicates that firms which hold the outstanding position of foreign currency derivatives at the end of the year are the foreign currency derivative users.

Variable:

FCD = 1 if the firm use foreign currency derivatives

= 0 otherwise

FCD equals to one if the firm reports the amount of foreign currency derivatives (such as forwards, futures, swap, and options) in the note of financial statement on the fiscal year 2005 and FCD is zero if the firm does not report the amount of foreign currency derivatives on fiscal year 2005.

FCD_TA = The proportion of foreign currency derivatives converted to baht to total asset reported in the note of financial statement on the fiscal year 2005.

Foreign currency derivative buying is converted with contract rate or, in case the firm does not define, this study uses offer rate of that foreign currency instead. Foreign currency derivative selling is transformed with contract rate or bid rate in case of the firm does not indicate the contract rate.

Corporate Tax Structure

The firm's expected tax liability can be reduced by hedging when firm was subject to the presence of a convex corporate tax function. Firm will have incentive to hedge when they have more convex in tax schedule. In Thailand, firms do not face with a progressive system but they have tax loss carry forward system. This tax preference can lead the incentive to hedge for reducing the pre-

tax cash flow volatility because the losses can be carried over to another fiscal year. This tax preference can be the cause of convexity in the tax function of the firm.

Variable:

TAX = 1 if the firm has tax loss carry forwards from the fiscal year 2004

= 0 otherwise

Expected Costs of Financial Distress

The transaction costs of financial distress can induce firms to hedge financial price risk because the probability of incurring the costs is reduced. That means hedging can increase the firm's value by lowering the financial distress cost. The use of foreign currency derivatives will increase with the probability of firm's financial distress. Moreover, many studies use return on asset ratio to be the proxy of financial distress because firm that has high profitability on assets will have less probability of financial distress.

Variables:

DE = Leverage defined as ratio of book value of debt to book value of total asset

INT = Interest coverage ratio defined as the earning before interest and tax payment over the interest payment in this period

ROA = Return on asset as ratio of earning before interest and tax to total assets

Costs of underinvestment: Firm growth opportunities

This hypothesis related to the agency cost theory. When firm is likely to go bankrupt, shareholders may not have an incentive to invest in new positive net present value projects since the return from investment accrues to the debtholders while the entire cost will be held by shareholders. Shareholders will be less hurt if the project had not been made. Hedging can reduce the incentive of

underinvestment by reducing the fluctuation of investment outcomes then the firm value will increase. Because firms with more future growth opportunities are more likely to face the underinvestment problem so they are more likely to use the foreign currency derivatives.

Variables:

MB = Market-to-book ratio

Firm which has the high growth opportunity should have more market value excess than book value.

PE = Price earning ratio defined as the firm's stock price at year end over the earning per share

Because of investor prospective, the demand in the stock will go up if they think that the company has the future growth opportunity so the price should be high.

Source of cash flow volatility: Foreign currency exposure

Firms with the foreign currency transactions will face the foreign currency exposures and this can be increase or decrease firm's value. The degree to which a firm's cash flow affected by foreign currency fluctuation should depend on the nature of its activities, such as the level of export sales and import activity involved in the foreign operation outside the country, the foreign income (fee, interest, dividend are denominated in foreign currency), the foreign investment, and the assets (cash and account receivable) and liabilities (account payable and foreign debt) which are denominated in foreign currency. With the limitation of the data, only export sales, foreign assets and foreign liabilities report in note of financial statement.

Variables:

EXPORT = The proportion of export sales to total sales

FASSET = The proportion of assets denominated in foreign currency translated into bath to total assets. Foreign assets are converted into baht with bid rate of each currency at the end of year 2005.

FLIABI = The proportion of liabilities denominated in foreign currency translated into baht to total assets. Foreign liabilities are converted into baht with offer rate of each currency at the end of year 2005.

Hedging substitutes

Many studies consider the existence of alternative methods of risk management on the decision to hedge with derivatives. Firms can reduce the financial distress cost by investing in more liquid assets because with their short term maturity, the debtholders can sure that fund will not default and can pay fixed claims. The high liquidity will negatively relate to the use of foreign currency derivatives. Moreover, dividend yield can also be the proxy of probability of financial distress. Firm with low dividend payout will have more residual cash flow available for payment to debtholders and therefore the lower of likelihood of the firm hedging. So the dividend payout will be positive correlation with the use of foreign currency derivatives (Yodpetch (2002)).

Variables:

LIQ = Liquidity ratio defined as current assets to current liabilities

QU = Quick ratio defined as the current assets excluded inventories to current liabilities

DY = Dividend yield defined as the dividend per share to the firm's stock price

Transaction cost: Economies of scale

Many studies indicate that firm's size can have positive or negative relation to the derivative usage depended on the point of consideration. Economies

of scale in the cost of using derivative might act as the barrier for the small firms to use the foreign currency derivatives, implying a positive correlation between the firm size and the use of foreign currency derivatives (large firms are more likely to hedge). On the other hand, the small firms have greater financing cost than the large firms which are likely to finance external funding so they will face more financial distress that incentive them to hedge. This can imply a negative correlation between the firm size and the use of foreign currency derivatives (small firms are more likely to hedge).

Variable:

SIZE = the natural log of total asset

Table 1 is the summary variables' explanations that use in this study. Table 2 presents the hypothesis and expected coefficient based on the corporate hedging theory.

Table 1Variables explanations

Dependent Variables	Explanations
1. The Use of Foreign Currency Derivative	Binary dummy variable equal to 1 if firm records the use of foreign currency derivative in the annual report or the note of financial statement and 0 otherwise
2. The Level on the Use of Foreign Currency Derivative	The gross amount of the foreign currency derivative use converted to baht scaled by total asset
Independent Variables	**Explanations**
1.Corporate Tax Structure	
Tax loss carry forward	Binary dummy variable equal to 1 if firm has tax loss carry forward in the previous year and 0 otherwise
2.Expected Costs of Financial Distress	
Interest coverage ratio	The ratio of earning before interest and tax to interest expenses
Debt-to-Asset ratio	The ratio of book value of debt to book value of total asset
Return on asset	The earning before interest and tax scaled by book value of total asset
3.Costs of underinvestment: Firm growth opportunities	
Market-to-Book ratio	Market value of equity plus book value of debt scale by book value of total asset
Price earning ratio	Price earning ratio is the ratio of firm's stock price at year-end to earning per share at that year
4.Source of cash flow volatility: Foreign currency exposure	
Export sale to total sale	The proportion of firm's export sale scaled by total sale
Foreign asset to total asset	The proportion of asset denominated in foreign currency converted to baht scaled by total asset
Foreign liability to total asset	The proportion of liability denominated in foreign currency converted to baht scaled by total asset
5.Hedging substitutes	
Current ratio	Total current asset scaled by total current liability
Quick ratio	The ratio of current asset deducted inventories to current liability
Dividend yield	Dividend per share to earning per share
6.Transaction cost: Economies of scale	
Firm size	The natural log of total asset.

Table 2 The coefficients, expected signs of all proxy variables based on the theory

Hypothesis	Variables		Expected sign
Tax function convexity	Tax loss carry forwards dummy	TAX	+
Expected cost of financial distress	Debt-to-asset ratio	DE	+
	Interest coverage ratio	INT	-
	Return on asset	ROA	-
Costs of underinvestment: Firm growth options	Market-to-book ratio	MB	+
	Price earning ratio	PE	+
Source of cash flow volatility: Foreign currency exposure	Foreign sales	EXPORT	+
	Foreign assets	FASSET	+
	Foreign liabilities	FLIABI	+
Hedging substitutes	Current ratio	LIQ	-
	Quick ratio	QUI	-
	Dividend yield	DY	+
Transaction cost: Economies of scale	The logarithm of total assets	SIZE	+/-

Model Specification

In the first stage, using all firms, I estimate a Binomial Logit Model in which the decision to hedge is related to variables that are broadly consistent with theories of optimal hedging and controls for foreign currency exposure.

The model is as follows:

$$\mathrm{Prob}(Y=1|X) = f(TAX, DE, INT, ROA, MB, PE, EXPORT, FASSET, FLIABI, LIQ, QUI, DY, SIZE)$$

The dependent variable is a binary variable which equals one if the firm hedges with foreign currency derivatives and zero if it does not.

Y=1 if the firm uses foreign currency derivatives.

Y=0 if otherwise.

In the second stage, using only those firms that chose to engage in hedging by using currency derivatives, I estimate a Tobit regression using the amount of foreign currency derivative use converted to baht scaled by total asset as a dependent variable. Using the same independent variables as the first stage, this regression identifies the factors that are important determinants of the amount of hedging, once a firm has decided to hedge.

$$FCD\_TA_i = \alpha + \beta_1 TAX + \beta_2 DE + \beta_3 INT + \beta_4 ROA + \beta_5 MB + \beta_6 PE + \beta_7 EXPORT + \beta_8 FASSET + \beta_9 FLIABI + \beta_{10} LIQ + \beta_{11} QUI + \beta_{12} DY + \beta_{13} SIZE + \mu_i$$

FCD_TA = the notional amount of foreign currency derivative at fiscal year 2005 converted to baht scaled by total asset.

5. Empirical Results

Table 3 contains the independent variables' statistics used in this study. This table provides the mean, median, standard deviation, maximum and minimum values of each independent variable. In 2005, there are 373 Thai listed firms, excluding non-trading group and financial sector. Table 4 presents those 98 out of 373 firms in the sample which disclose the foreign currency derivative holdings at the end of 2005. Agriculture firms have more foreign currency derivative use related to international transactions such as export sales.

Table 3 Independent Variables-Summary Statistics

This table provides summary information for the independent variables used in this analysis. Tax loss carry forward is defined as dummy variable equal to one if firms have tax loss carry forward and 0 otherwise. Interest coverage ratio is the ratio of earning before interest and tax to interest expenses. Debt-to-asset ratio is the ratio of book value of debt to book value of total asset. Return on asset is the earning before interest and tax scaled by book value of total asset. Market-to-book ratio is market value of equity plus book value of debt scale by book value of total asset. Price earning ratio is the ratio of firm's stock price at year-end to earning per share at that year. Export sale to total sale is the proportion of firm's export sale scaled by total sale. Foreign asset to total asset is the proportion of asset denominated in foreign currency converted to baht scaled by total asset. Foreign liability to total asset is the proportion of liability denominated in foreign currency converted to baht scaled by total asset. Current ratio is measured by current asset scaled by current liability. Quick ratio is the ratio of current asset deducted inventories to current liability. Dividend yield is measured by dividend per share to earning per share and firm size is defined by natural log of total asset.

Independent Variable	Mean	Median	Max	Min	Std. Dev.
1.Corporate Tax Structure					
Tax loss carry forward (Dummy variable)	0.223	0.000	1.000	0.000	0.416
2.Expected Costs of Financial Distress					
Interest coverage ratio	46.380	6.371	258.889	-2.457	86.423
Debt-to-asset ratio	0.470	0.462	4.181	0.006	0.350
Return on asset	0.055	0.060	0.476	-1.863	0.139
3.Costs of underinvestment: Firm growth opportunities					
Market-to-Book ratio	1.060	0.869	4.540	0.248	0.655
Price earning ratio	15.259	8.585	1501.355	-195.652	83.982
4.Source of cash flow volatility: Foreign currency exposure					
Export sale to total sale	0.144	0.000	0.988	0.000	0.274
Foreign asset to total asset	0.037	0.000	0.664	0.000	0.098
Foreign liability to total asset	0.045	0.000	0.799	0.000	0.098
5.Hedging substitutes					
Current ratio	1.938	1.297	18.677	0.003	2.077
Quick ratio	1.080	0.701	12.058	0.001	1.328
Dividend yield	0.039	0.036	0.157	0.000	0.037
6.Transaction cost: Economies of scale					
Firm size (natural log of total assets)	21.887	21.662	27.200	18.614	1.403

Table 4 Summary Statistic of foreign currency derivative users and non-foreign currency derivative users.

Sector	Number of firms	
	Non-use FCD	Use FCD
AGRIBUSINESS	8	13
AUTOMOTIVE	13	6
COMMERCE	11	4
CONSTRUCTION MATERIALS	19	8
ELECTRONIC COMPONENTS	6	6
ENERGY & UTILITIES	10	8
FASHION	24	3
FOODS & BEVERAGES	16	8
HEALTH CARE SERVICES	13	0
HOME & OFFICE PRODUCTS	7	4
INDUSTRIAL MATERIALS AND MACHINERY	16	3
INFORMATION AND COMMUNICATION TECHNOLOGY	9	13
MEDIA AND PUBLISHING	23	2
MINING	1	0
NON-PERFORMING GROUP	6	0
PACKAGING	10	3
PAPER & PRINTING MATERIALS	1	2
PERSONAL PRODUCTS & PHARMACEUTICALS	3	0
PETROCHEMICALS&CHEMICALS	5	9
PROFESSIONAL SERVICES	2	0
PROPERTY DEVELOPMENT	47	2
TOURISM AND LEISURE	14	1
TRANSPORTATION & LOGISTICS	10	3
Total	**275**	**98**
All of observations	**373**	

Table 5 Differences between Foreign Currency Derivative Users (U) and Non-Foreign Currency Derivative Users (UN) Using Two Sample T-Test

This table presents the results for tests of the equality of mean between foreign currency derivative users and non-foreign currency derivative users.

	Expected relation	U-NU	Use FCD (98 obs.)		Not use FCD (275obs.)			
			Mean	STD	Mean	STD	Mean diff	t-Test
Tax loss carry forward	**U>NU**	+	0.244	0.432	0.190	0.393	0.054	1.114
Interest coverage ratio	**U<NU**	-	33.279	72.698	51.049	90.478	-17.770	1.752***
Debt-to-Asset ratio	**U>NU**	+	0.444	0.192	0.479	0.391	-0.035	0.855
Return on asset	**U<NU**	-	0.049	0.113	0.057	0.146	-0.008	0.486
Market-to-Book ratio	**U>NU**	+	1.008	0.484	1.078	0.705	-0.070	0.902
Price earning ratio	**U>NU**	+	21.198	153.335	13.143	35.143	8.055	0.815
Export sale to total sale	**U>NU**	+	0.204	0.308	0.123	0.258	0.080	2.505**
Foreign asset to total asset	**U>NU**	+	0.092	0.158	0.018	0.052	0.075	6.872*
Foreign liability to total asset	**U>NU**	+	0.081	0.112	0.032	0.089	0.049	4.366*
Current ratio	**U<NU**	-	1.780	1.801	1.994	2.167	-0.214	0.874
Quick ratio	**U<NU**	-	1.043	1.472	1.093	1.276	-0.050	0.322
Dividend yield	**U>NU**	+	0.046	0.038	0.036	0.036	0.010	2.318**
Firm size	**?**	+/-	22.009	1.296	21.844	1.439	0.166	1.004

*, **, *** Denote significance at 1, 5, and 10% levels, respectively

Univariate Analysis

Table 5 compares the means of independent variables between foreign currency derivative users and non-foreign currency derivative users, and presents the significance of these proxy variable differences. The second and third columns summarize the expected signs based on the theory between foreign currency derivative users and non-foreign currency derivative users. The forth and fifth columns present the means and standard deviations for the 98 foreign currency derivative users. For the 275 non-foreign currency derivative users, the means and standard deviations are presented in the sixth and seventh columns respectively. The last column contains the t-Test values of the differences by means of the proxy variables.

Ten of thirteen relationships are the same as theory prediction but only five of these relationships are statistically significant. Foreign asset to total asset (FASSET) and foreign liability to total asset (FLIABI) are significant at the 1% significance level and export sale to total sale (EXPORT) is significant at 5% significance level. These results support the hypothesis that the firm which faces more foreign currency exposures might have more likelihood to use foreign currency derivatives to eliminate the cash flow volatility. Dividend yield (DY) and interest coverage ratio (INT) are significant at 5% and 10% significance level respectively. Foreign currency derivative users appear to have more dividend payment than non-foreign currency derivative users. This is consistent with the hypothesis that firms can reduce the bankruptcy cost by assuring debtholders of their ability to service the payments by deducting the dividend payout ratio instead of using foreign currency derivative. Foreign currency derivative users appear to have less interest coverage ratio that support the expected financial distress cost hypothesis and might lead firms to have more likelihood to use foreign currency derivatives. The mean comparison shows that foreign currency derivative users have larger firm's size than non-foreign currency derivative users. This result supports the transaction cost hypothesis that economies of scale in the cost of using derivatives might act as the barrier for the small firms to use the foreign currency derivatives.

Surprisingly, although the interest coverage ratio (INT) is significant, the debt-to-asset ratio (DE) is insignificant different. According to Graham and Roger (2002), this is may be related to the uncontrolled bankruptcy costs. Because of DE is assumed to be constant across firms that mean the uncontrolled bankruptcy costs do not affect the firms' debt financing.

Tests and results

Logit regression on firm's decision to use foreign currency derivative

This section presents the multivariate testing results which investigate the significant factors that affect the firm's decision to use foreign currency derivatives by using Logistic regression. The binary dependent variable is one for firms that use foreign currency derivatives, and all other firms are assigned to value of zero. In Logistic analysis, the binary foreign currency derivative use is regressed on the optimal hedging theory variables which are corporate tax function, the expected cost of financial distress, costs of underinvestment, source of cash flow volatility, Hedging substitutes, and transaction cost.

Table 6 presents all of results from regression. The second column presents the expected sign based on the hypothesis. The third and forth columns contain the results from Logit and Tobit regression by using all of proxy variables related to the theory. Additionally, the fifth and sixth columns present the re-estimate results by using dummy variable of export sale which equal to 1 if firms have export sale and 0 otherwise instead of using the proportion of export sale to total sale.

Table 6 Factors explaining the use and the level of foreign currency derivative use

The table provides estimated parameters (top) and z-statistics (bottom) using Two-stage model. The first stage is the binomial Logit estimation that relates proxy factors for theories of optimal hedging and for exposure to foreign currency movements to a firm's likelihood of using foreign currency derivatives. The dependent variable is a binary variable equal to 1 if a firm uses foreign currency derivative and 0 otherwise. The second state is a Tobit regression model in which we consider only those firms that chose to hedge for estimating which factors influence a firm's decision on the level of derivative use. For The third and forth regression, I use dummy variable of export sale instead of amount of export sale to total sale.

Regression Dependent Variables	Expected signs	Eq.1 Logit Use FCD=1 otherwise=0	Eq.2 Tobit FCD to total asset > 0	Eq.3 Logit Use FCD=1 otherwise=0	Eq.4 Tobit FCD to total asset > 0
Intercept		-3.2297	-0.1348	-3.9610	-0.1668
		(-1.496)	*(-1.068)*	*(-1.807)*	*(-1.298)*
Tax loss Carry forward	+	-0.6203	-0.0332	-0.6648	-0.0358
		*(-1.690)****	*(-1.651)****	*(-1.791)****	*(-1.742)****
Interest Coverage Ratio	_	-0.0038	-0.0001	-0.0039	-0.0001
		*(-1.919)****	*(-1.503)*	*(-1.936)****	*(-1.518)*
Debt to asset ratio	+	-0.7635	-0.0442	-0.6022	-0.0394
		(-1.143)	*(-1.145)*	*(-0.909)*	*(-1.006)*
Return on asset	_	2.8314	0.1285	2.6093	0.1406
		(1.542)	*(1.223)*	*(1.503)*	*(1.310)*
Market to book ratio	+	-0.1647	-0.0115	-0.1839	-0.0137
		(-0.646)	*(-0.755)*	*(-0.724)*	*(-0.880)*
Price earning ratio	+	-0.0002	-0.0000057	-0.0002	-0.0000061
		(-0.203)	*(-0.823)*	*(-0.185)*	*(-0.868)*
Dummy variable of export sale to total sale	+			0.6518	0.0204
				*(2.330)***	*(1.256)*
Export sale to total sale	+	-0.3623	-0.0157		
		(-0.626)	*(-0.518)*		
Foreign asset to total asset	+	8.9705	0.5380	7.0823	0.5018
		*(4.141)**	*(7.354)**	*(4.067)**	*(7.589)**
Foreign liability to total asset	+	3.8591	0.1500	3.4442	0.1358
		*(2.909)**	*(2.069)***	*(2.670)**	*(1.852)****
Current ratio	_	-0.0665	-0.0053	-0.0756	-0.0055
		(-0.580)	*(-0.755)*	*(-0.652)*	*(-0.762)*
Quick ratio	_	0.1226	0.0075	0.1553	0.0085
		(0.781)	*(0.793)*	*(0.974)*	*(0.877)*
Dividend yield	+	7.6658	0.3079	7.7748	0.3158
		*(2.161)***	*(1.513)*	*(2.162)***	*(1.532)*
Firm size	+/-	0.0907	0.0027	0.1084	0.0036
		(0.941)	*(0.480)*	*(1.109)*	*(0.644)*
Log likelihood function		-179.8081	-15.4200	-177.5893	-14.7477
Pseudo R^2		0.162943	0.241103	0.173272	0.232295
Censored observations		275	275	275	275
Uncensored observations		98	98	98	98
Total observations		373	373	373	373

*, **, *** Denote significance at 1, 5, and 10% levels, respectively

Equation 1

$$FCD_i = \alpha + \beta_1 TAX + \beta_2 INT + \beta_3 DE + \beta_4 ROA + \beta_5 MB + \beta_6 PE + \beta_7 EXPORT + \beta_8 FASSET + \beta_9 FLIABI + \beta_{10} LIQ + \beta_{11} QUI + \beta_{12} DY + \beta_{13} SIZE + \mu_i$$

The first state results show that tax loss carry forward, TAX, is statistically significant and has the unexpected sign (negative sign). Although many studies use this variable to indicate incentive to hedge from the tax benefit, in this study, tax loss carry forward dummy variable may not appropriate to identify the incentive to use foreign currency derivative that outcome from the tax function convexity. This result can explain by argument about losses that firms expect to bear in the future. Graham and Roger (2002) state that firms with expected losses provide a tax disincentive to hedge but provide an incentive to hedge for firms that expected to be profitable. It means that if a firm expects to lose money, hedging reduces right tail outcomes and the chance that firm will use its existing tax preference losses. They indicate that tax loss carry forward variable may measure expected financial distress cost rather than a tax incentive to hedging.

The cost of financial distress variables, DE and ROA show statistically insignificant and they have an unexpected sign. Only INT has significant expected sign. The result shows that both variables, DE and ROA, do not support the hypothesis of expected financial distress cost. However, these proxies of expected cost of financial distress may have some concern ,according to Graham and Roger (2002), DE is assumed that uncontrolled bankruptcy costs are constant across firms that mean the uncontrolled bankruptcy costs do not affect the firms' debt financing. In fact, a high uncontrolled bankruptcy cost firm might have a low level of debt or on the other hand, a low uncontrolled bankruptcy cost firm might have a high level of debt. With this assumption, it can imply that firm with high DE may have the low probability of financial distress and may have a low amount of using foreign currency derivative. For cost of underinvestment hypothesis, the result shows that all of proxy variables, MB and PE, are statistically insignificant which do not support the cost of underinvestment hypothesis. Yodpetch (2002) also finds the insignificant relationship of this hypothesis.

Hypothesis of foreign currency exposures, same as expectation, FASSET and FLIABI have the significant positive relation with the foreign currency derivative use. This result supports that firm which face high level of foreign currency exposure has incentive to use foreign currency derivative to mitigate the firm cash flow volatility. Only EXPORT has statistically insignificant. This contrary result of EXPORT might come from data limitation that exporters use the foreign currency derivatives during the year but have no record of outstanding position at the end of year, therefore, this study indicates that exporter do not use foreign currency derivatives.

For hedging substitute hypothesis, this study test the use of foreign currency derivative would expect to be a negative correlation to the hedging substitute. The results show that LIQ provides a negative coefficient but QUI has a contrary sign and both are statistically insignificant. On the other hand, DY has the statistically significant positive sign. The evidence support the hedging substitute hypothesis which states that high dividend payment firms are more likely to have more derivative usage. According to Nance et al (1993), firm which low dividend payout makes firm more likely that funds will be available to service the debt payments and will have less likelihood to use foreign currency derivative. So dividend payout ratio might have a positive correlation with the foreign currency derivative use.

Finally, transaction cost hypothesis, SIZE, the coefficient is insignificant but has the positive expected sign. The result supports this hypothesis that large firm might have more incentive to use foreign currency derivative because it has benefit from economies of scale and has less a barrier to hedging than small firm.

Tobit regression on firm's level of using foreign currency derivative

Equation 2

$$FCD\_TA_i = \alpha + \beta_1 TAX + \beta_2 INT + \beta_3 DE + \beta_4 ROA + \beta_5 MB + \beta_6 PE + \beta_7 EXPORT + \beta_8 FASSET + \beta_9 FLIABI + \beta_{10} LIQ + \beta_{11} QUI + \beta_{12} DY + \beta_{13} SIZE + \mu_i$$

Where

FCD_TA = the notional amount of foreign currency derivative use converted to bath scaled by total assets.

In the second stage, using only those firms that chose to engage in hedging by using foreign currency derivatives, this study estimates a Tobit regression using the amount of foreign currency derivative use to total asset as a dependent variable. Using the same independent variables as the first stage, this regression identifies the factors that are important determinants of the amount of hedging, when a firm has decided to hedge.

The second state result is consistent with the first state result that the important factors of level of foreign currency derivative use are TAX, FASSET, and FLIABI. This study suggests those foreign currency exposures (FASSET and FLIABI) and the expected cost of financial distress (TAX) factors are the important factors that prompt firm to hedge and determine the hedging degree.

The result above shows the contrary sign of foreign currency exposure variable, EXPORT. To solve this problem, I re-estimate the model by using dummy variable of export sale which equal to 1 if the firm has export sale to total sale and 0 otherwise. I examine the separate decision to use foreign currency derivative and the level of foreign currency derivative use. In equation 3, I find the significant negative sign of TAX and all of proxy of foreign currency exposure has the significant positive relation with the level of foreign currency derivative use. This regression shows the accurate result with higher log likelihood value and pseudo R^2 value of equation 3 compared to equation 1 (-179.8081<-177.5893, 0.162943<0.173272) and export sale to total sale dummy variable turn to be positively significant which consistent to the expectation.

In the second stage, Equation 4, I also investigate the important factors on the level of foreign currency derivative use by using Tobit regression. This regression shows the consistent result as the equation 2, TAX, FASSET, and FLIABI are the important significant factors of the amount derivative use once firm decides to use foreign currency derivative.

In addition to foreign currency derivatives, firms can also use foreign liability to protect themselves from foreign currency exposures by balance sheet maturity and currency matching. A firm with foreign revenues through export sales (foreign cash inflows) can issue foreign liability (e.g. account payable denominated in foreign currency or foreign debt) because this creates a cash outflow of foreign currency. It can indicate that firms with foreign operation and issuing the foreign liability use the natural hedging strategy. Because foreign currency liability represents the foreign currency cash outflow, it is only be used as hedging instrument when the firm has export sales or assets denominated in foreign currency.

Table 7 presents the results from regression that dependent variable is a binary dummy variable of foreign currency liability. The second column presents the expected sign based on the hypothesis. The third and forth columns contain the results from Logit and Tobit regression by using all of proxy independent variables related to the theory. Additional, the fifth column presents the results that compare between the decision of foreign currency derivative use and foreign currency liability.

Logit regression on firm's decision to use foreign currency liability

Equation 5:

$$DFLIABI_i = \alpha + \beta_1 TAX + \beta_2 INT + \beta_3 DE + \beta_4 ROA + \beta_5 MB + \beta_6 PE + \beta_7 EXPORT + \beta_8 FASSET + \beta_9 LIQ + \beta_{10} QUI + \beta_{11} DY + \beta_{12} SIZE + \mu_i$$

The first stage, same independent variables of on foreign currency derivative testing, the dependent variable is a binary dependent indicating whether or not a firm uses foreign currency liability. The Logit regression result from table 7, equation 5, shows that the same results from equation 1, EXPORT, FASSET, and DY is also significant and consistent with the hypothesis. Moreover, SIZE has the significant negative sign which imply that small firms are more likely to issue foreign currency liability than the large firms. This is consistent with that small firms has more transaction costs and less information of using foreign currency derivative, so they tend to use the natural hedging by issuing the foreign currency liability through foreign account payable or foreign debt.

Tobit regression on firm's level of using foreign currency liability

Equation 6:

$$FLIABI_i = \alpha + \beta_1 TAX + \beta_2 INT + \beta_3 DE + \beta_4 ROA + \beta_5 MB + \beta_6 PE + \beta_7 EXPORT + \beta_8 FASSET + \beta_9 LIQ + \beta_{10} QUI + \beta_{11} DY + \beta_{12} SIZE + \mu_i$$

In the second stage, Tobit regression, not only EXPORT, FASSET, DY, and SIZE but also INT is significant to support that the cost of financial distress is the important determinant of the level of issuing foreign currency liability. TAX turns to have the significant positive sign. The result also suggests that tax benefit provide incentive for issuing foreign liability as hedging. Firm with tax loss carry forward might have to fulfill the advantage from tax preference that lead firm to have more incentive to reduce pre-tax income volatility hedging.

Finally, this study uses the Logit regression to test a model of choice that compares the use of foreign currency derivative (FCD) and foreign currency liability (FLIABI). The dependent variable is a binary equal to one if the firm uses foreign currency derivative and zero if the firm issues foreign currency liability.

The result presents that firms that use foreign currency derivatives might have less tax loss carry forward than firms which issue foreign currency liability. Surprisingly, this study finds that EXPORT has the negative sign which implies that exporters tend to prefer issuing foreign currency liability over the use of foreign currency derivative. This unexpected result might be from that EXPORT is the accumulate value of export sale since the beginning of the year while the amount of foreign currency derivative use focuses on at the end of year. So there is might be data limitation in case of exporting firms have no outstanding derivatives at the end of year since they have already settlement. Firms which have asset denominated in foreign currency have likelihood to use foreign currency derivative. This might be explained by the more convenience and accessibility of foreign currency derivatives. Large firms have more likely to use foreign currency derivatives related to the transaction costs and economies of scale.

Table 7 Factors explaining the use and the level of foreign currency debt use

The table provides estimated parameters (top) and z-statistics (bottom) using Two-stage model. The first stage is the binomial logit estimation that relates proxy factors for theories of optimal hedging and for exposure to foreign currency movements to a firm's likelihood of using foreign currency liability (FLIABI). The dependent variable is a binary variable equal to 1 if a firm uses foreign currency liability and 0 otherwise. The second state is a Tobit regression model in which we consider only those firms that chose to hedge for estimating which factors influence a firm's decision on the level of foreign currency liability use.

Regression Dependent Variables	**Expected Signs For Eq5. and Eq.6**	**Eq.5 Logit Use FLIABI=1 otherwise=0**	**Eq.6 Tobit FLIABI > 0**	**Eq.7 Logit Use FCD=1 FLIABI = 0**
Intercept		3.1801	0.2270	-5.6215
		(1.355)	*(1.091)*	*(-1.941)*
Tax loss Carry forward	+	0.2794	0.0517	-0.8946
		(0.831)	*(1.753)***	*(-2.142)***
Interest Coverage Ratio	_	-0.0033	-0.0003	-0.0025
		(-1.631)	*(-1.997)***	*(-0.980)*
Debt to asset ratio	+	-0.1367	0.0095	-0.6010
		(-0.240)	*(0.198)*	*(-0.659)*
Return on asset	_	0.0005	0.0497	2.2002
		(0.000)	*(0.515)*	*(1.150)*
Market to book ratio	+	0.0513	-0.0103	-0.3117
		(0.226)	*(-0.554)*	*(-1.026)*
Price earning ratio	+	-0.0006	0.000005	0.00067
		(-0.163)	*(0.153)*	*(0.398)*
Export sale to total sale	+	1.2962	0.1268	-1.0549
		*(2.052)***	*(2.535)***	*(-1.589)*
Foreign asset to total asset	+	15.5616	0.8398	5.4038
		*(3.321)**	*(3.561)**	*(2.574)**
Current ratio	_	-0.0635	-0.0102	-0.0817
		(-0.609)	*(-0.974)*	*(-0.455)*
Quick ratio	_	-0.0183	0.0012	0.1755
		(-0.111)	*(0.077)*	*(0.712)*
Dividend yield	+	11.3824	0.7661	-0.2133
		*(2.836)**	*(2.240)***	*(-0.050)*
Firm size	+/-	-0.2037	-0.0159	0.2829
		*(-1.898)****	*(-1.680)****	*(2.182)***
Log likelihood function		-149.0916	-40.61951	-116.2447
Pseudo R^2		0.155835	0.109995	0.106769
Censored observations		181	181	94
Uncensored observations		94	94	90
Total observations		275	275	184

*, **, *** Denote significance at 1, 5, and 10% levels, respectively

6. Conclusion

Under the managed floating rate regime, multinational corporations are exposed with the foreign currency movement. Firms with the foreign currency transactions have more attention to foreign currency risk management by using foreign currency derivatives as the hedging instruments. Firms use foreign currency derivatives to reduce their foreign currency exposures and when risk is reduced so as the volatility of corporate earnings, in general, might increase the firm value.

This study provides empirical evidence testing the incentive to use foreign currency derivative for hedging hypothesis based on Modigliani and Miller theory (1958) which are tax function convexity, the expected cost of financial distress, the costs of underinvestment, source of cash flow volatility, hedging substitutes, and transaction cost. Using a recent data sample of Thai listed non-financial firms for 2005, this study examines the important factors of firms' decision to use foreign currency derivatives, and the factors that influent their decision on amount to use foreign currency derivatives by using two-stage regression.

This study finds that, in the first stage using Logit regression, firms more likely use foreign currency derivatives to reduce the expected cost of financial distress and firms with more foreign transactions through foreign asset and foreign liability have more likelihood to use foreign currency derivative for reduce cash flow volatility. Firms also reduce the financial distress by reducing the liquidity constrains. In the second state, this study finds the same factors that affect the amount of use foreign currency derivatives. This study suggests that the expected cost of financial distress and foreign currency exposures are the important factors that influent both firms' decision to use and the amount of using foreign currency derivative.

Firms can also use foreign currency liability, as hedging instrument, to reduce their foreign currency exposures, natural hedging strategy. Similarly, this study finds that foreign currency exposures through export sale and foreign asset are also important factors of their decision to use foreign liability and influence

the amount of foreign liability. Moreover, this study suggests that small firms tend to issue more foreign liability than large firms because of transaction costs of derivative using.

This study analyzes the choice of using hedging methods between foreign currency derivative and foreign liability and finds that exporters are more likely to issue foreign liability. The interpretation might come from the data limitation that export sale is the accumulate value since the beginning of the year while the amount of foreign currency derivative use focuses on at the end of year. So there might have some misunderstanding in case of exporting firms have no outstanding derivatives at the end of year since they have already settlement these contracts. Moreover, firms which hold foreign assets are more likely to use foreign currency derivatives than issue the foreign liability due to the more understanding of the foreign currency derivative.

This study contributes the important implications for corporate foreign currency risk management in Thailand. It provides the better understanding of firms' hedging decision. The empirical results suggest that firms with the high expected financial distress cost have the more likelihood to engage in hedging. Furthermore, foreign currency exposures are the main factors to prompt firms to use foreign currency derivative and guide their decision on how much to use.

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