LINKAGE BETWEEN STOCK VOLATILITY AND CORPORATE BOND YIELD SPREAD IN THAILAND

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An Independent Study
Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science (Finance)

Master of Science Program in Finance
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Faculty of Commerce and Accountancy
Thammasat University, Bangkok, Thailand
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Thammasat University

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An Independent Study

By

Mr.Supat Mongkonkiattichai

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Linkage between Stock Volatility and Corporate Bond Yield Spread in Thailand

ABSTRACT

This paper studies the relationship between stock volatility and corporate bond yield spread in Thai market by following Campbell and Taksler (2003) panel data regression approach. We extend this approach by applying GARCH (1,1) from a market model to estimate the time-varying stock volatility and we also include the bear market period dummy variable to capture any effects on yield spread. The results show that the equity volatility's variables such as firm's idiosyncratic risk, market risk, individual stock return and market return are able to explain the corporate bond yield spread. Surprisingly, these variables could explain the spread better than credit rating variables. Furthermore, during bear market period, yield spreads of financial firms bonds are increasing significantly.

I. INTRODUCTION

Thailand is a developing country in South East Asia and the capital market had just emerged since April 1975. The financial system of the country is a bank based system. However, after financial crisis in 1997, many firms had raised their fund by either issuing corporate bond in the bond market or issuing equity in the stock market instead since most banks faced with tight liquidity problem and needed to reduce the credit line. Therefore, both stock and bond markets in Thailand have been growing in values as shown in figure 1 below.

[Figure 1 is here]

From figure1, after the country recovered from economic crisis in 2002, the size of stock market was almost doubled in 2003. At the same time, the capital values of bond market and bank loans were increasing slightly, but they were less volatile compared to those of the equity market during the past years. Recently, Thai market has an economic recession once again during 2007-2008 due to sub-prime crisis in the U.S. market and the political uncertainty in Thailand.

From Merton (1974), the contingent claims model views equity investor as the holder of call option on firm's value and views corporate bond investor as the holder of risk free bond altogether with write put option on firm's value, so the firm's volatility will affect both equity holder and bond holder. Since the firm volatility is one of the key driven factors of call and put option as stated by Black and Scholes' model (1973), equity holders will gain at the expense of bond holders when the firm's volatility increases. This result from the fact that both call and put options on firm's value will increase from the rising volatility. Since bond holders are on the short position of put option, so, their total value of portfolio declines. The payoff on both securities was illustrated in Figure 2.

[Figure 2 is here]

Although we understand that firm's volatility will have an impact on stock and corporate bond value, this variable is quite difficult to detect. Referring to balance sheet equation, firm value equals debt value plus equity value, so we can apply the portfolio variance theorem to find the firm's volatility (σ_F). This variable is derived from 5 components, which are the

weight of debt (W_D), the weight of equity (W_S), the debt's volatility (σ_D), the equity volatility (σ_S) and the correlation between debt and equity ($\rho_{D,S}$) as shown in the formula below.

$$\sigma_F = \sqrt{(W_D^2\sigma_D^2) + (W_S^2\sigma_S^2) + (2W_D W_S \rho_{D,S})} \qquad (1)$$

According to formula of Markowitz's portfolio variance above, we can see that in order to observe the firm's volatility, we need to estimate all 5 variables. Nevertheless, some variables such as the debt's volatility (σ_D) and the correlation between debt and equity ($\rho_{D,S}$) are hardly observable. As a result, for practical purpose, we will follow Campbell and Taksler (2003), Zhang et al (2005) and Bednarek (2006) and use stock volatility (σ_S) as a proxy for the firms' volatility. They also studied how the firm's volatility affects bond holders through credit spread, which is the difference in yield between corporate bond and government bond. This spread reflects the probability of default of the firm along with the risk premium that bondholder required from investing in corporate bond.

The objective of this paper is to investigate whether the stock volatility as a proxy for firm volatility influences corporate bond yield spread in Thai market. As far as we know, there is no study including the firm-level specific volatility, which was the important variable as Merton (1974) advised, to explain the corporate bond yield spread using Thai data. At the moment, there are only a few researches on Thai markets about the determinant of corporate bond yield spread.

In this paper, we will follow Campbell and Taksler (2003) by applying panel data regression to investigate the relationship and linkage between stock volatility and corporate bond yield spread. Knowing this relationship could help investors when making decision on investment as well as providing empirical evidences of Merton (1974) theory in Thai market. Additional contribution in this study is to apply GARCH (1,1) from market model to estimate the stock volatility as in Campbell et al (1997) instead of using only the historical standard deviation from a market-adjusted-return model. The major advantage of using GARCH (1,1) is that it incorporates latest information and recent historical volatility to forecast current volatility. Hence, the volatility, which estimated from this methodology, could reflect the

time-varying, while simple standard deviation assumes a constant volatility. Furthermore, we include the bear market period dummy variable in order to find out whether during bear market period, the corporate bond yield spread and other estimated parameters would change.

The remainder of this paper is structured as follows. Section II shows the related literatures and theories including the findings of previous researchers on international and Thai markets. Next, section III explains the methodology and also gives details of the relevant explanatory variables. Then section IV describes the data and sources, which we used as proxies for the explanatory variables in the model. After that, section V shows the empirical results and interpretations. Finally, section VI shows conclusion.

II. LITERATURE REVIEW

Relationship between stock and corporate bond had been studied by several researchers over the past 3 decades. Merton (1974) initiated the structure approach of contingent claim model in order to price the corporate bond. In his theory, the corporate bond, which is the risky asset, can be taught as long position in riskless bonds altogether with short position in European put options on firm value, which have strike price equal to face value of debt. On the other hand, the value of equity can be taught as a long position in European call option on firm value. In this view, if the assumptions of Black and Scholes' option pricing model (1973) hold, the value of both corporate bond (CB) and stock (S) will depend on 5 variables, which consist of the current firm value (V_F), the face value of debt at maturity (X), the level of risk free rate (r_f), the time to maturity of bond (T) and the firm's volatility (σ_F). Nevertheless, only 3 variables (V_F, r_f, σ_F) are stochastic. Pricing formula of stock (S) and corporate bond (CB) as imply from Black, Scholes and Merton's model shows below.

$$S = V_F N(d_1) - Xe^{-r_f T} N(d_2) \qquad (2)$$

And $$CB = Xe^{-r_f T} - (Xe^{-r_f T} N(-d_2) - V_F N(-d_1)) \qquad (3)$$

Where, $d_1 = \dfrac{\ln(V_F / X) + (r_f + {\sigma_F}^2 / 2)T}{\sigma_F \sqrt{T}}$ and $d_2 = d_1 - \sigma_F \sqrt{T}$

At *Cetaris Paribas*, when the firm value (V_F) improves, both bond holder and stock holder will gain due to positive relationship between underlying value and call option, while negative relationship between underlying value and put option (Recall that debt holder shorts put option, therefore, they gain in this case). However, when firm volatility increases, equity holder gains at the expense of bondholder because both call and put options will increase. For interest rate level, the rising will have positive impact to stock holder as call option value increased, nevertheless, the impact to bond holder cannot conclude yet. Since the bond investors hold risk free bond along with write put option, hence, increasing in interest rate level will have negative impact to the long position in risk free bond, and however, short position in put option will be gain. So, total effect of corporate bond value will depend on the sensitivity of interest rate to the put option value (*rho*) and the sensitivity of interest rate to the government bond value (Duration and Convexity).

For other studies, Fama and French (1993) confirmed that stock return was linked to bond return. Followed by Kwan (1996), who found stock return and corporate bond yield are negatively correlated, which means that an increase in stock return will lead to the lessen corporate bond yield. Likewise, Kim and In (2007) had observed that changes in stock prices and bond yields do not move together in most G7 countries, except in Japan. Nevertheless, Treptow (2002) indicated that stock and bond of the same company tends to have positive correlation, which means that the underlying firm's value is the dominant factor when pricing both securities. He also discovered that stock market absorb information into price earlier than bond market.

Similarly, Gebhardt et al (2004) found that both equity and debt instruments under react to firm intrinsic value. Anyway, past equity return is a better proxy of firm fundamentals than past bond return. Lamdin (2003) also implemented causality test in U.S. market and found that the stock market movement leads the changes in yield spread, while the opposition does not.

Even so, there are some several researchers that study about the credit rating changes to stock return. For example, Pinches and Singleton (1978) examined whether bond rating changes impact to stock return and they found that no significant abnormal stock return appear

after new rating announced. However, Griffin and Sanvicent (1982) and Dichev and Piotrosk (2001) explored that only bond downgrading has an effect on stock price, but not vice versa to bond upgrading.

For credit spread determinants, most of studies still appear in developed countries like America, Australia, EURO countries and Japan. For instance, in U.S. market, Longstaff and Schawartz (1995) discovered that credit spreads are inverse correlated with return on firm's asset (ROA) or equity (ROE), whereas, Campbell and Taksler (2003) argued that this spread could be explained by the idiosyncratic firm-level volatility. Moreover, Zhang et al (2005) had used the firm-level volatility and jump risks to explain the spread in credit default swaps. In contrast, Collin-Dufresne et al (2001) proposed that a change in credit spread was determined by aggregate factors more than firm specific factors.

However, Elton et al (2001) found that spread can explain by 3 factors, which are the loss from expected default, state and local taxes and systematic risk premium, but the main factor arises from market risk premium. Also, Bednarek (2006) showed that the credit spread of investment grade bond is mainly associated with market volatility. Conversely, for the low grade bond, this spread is much more linked to the total risk. Van Lanschoot (2008), who considered in both U.S. and Euro markets, also got the noteworthy impact of stock market's volatility to the yield spread. Nevertheless, Bewley et al (2004) examined the Australian market data during July 1998- Mar 2001, and discovered that stock market's volatility, which resulting from GARCH (1,1) model, has the main negative impact to credit spread.

Unlike Elton et al (2001), who used coupon rate as a proxy of state and local taxes to determine credit spread and find that coupon rate has positive impact to credit spread, Tsuji (2005) studied relationship of credit spreads in Japan and considered that coupon rate was an important factor to reflect investor's preference instead. He also presented the theoretical argument that a higher (lower) coupon rate will shorten (longer) duration and has lower (higher) interest rate risk. Therefore, this coupon bond will attract (repel) investors, who have higher (lower) interest rate risk aversion, and will lead the price of coupon bond to increase (decrease). As a result, the yield declines (increases) and its spreads shrink (expand). On

summarize, an increase (decrease) in investor's risk aversion generates a negative (positive) correlation between coupon and spreads.

For the impact of expected default, Huang and Huang (2002) found that credit risk accounts for only small fraction of the spread for investment grade bond, whereas, it accounts for a lot higher portion for junk bond. Nevertheless, Longstaff et al (2005) argued that the preponderance of corporate bond spreads is due to default risk.

The credit spread could determine by the market return as well. Lamdin (2003), Van Lanschoot (2008) and Davies (2008) found the similar results that the return of S&P500 play a vital role to explain the yield spreads. Davies (2008) claimed that when equity market rose, firms leverage declined, thus, corporate bonds will have lower chance to default and the credit spread should be tightened. In addition, equity market also reflects expectation of future economy. Besides, he proposed that an increase in industrial production tends to increase asset value and leads to higher recovery rate. As a result, the price of corporate bond increases, while its yield declined and leads the yield spread to be tightened.

Guha and Hiris (2002) found the strong evidence that the credit spread performs counter-cyclically. They got a strong support that corporate bond spread is closely associated to the business cycle and have a tendency to increase during recession. Van Lanschoot (2008) observed the same result during recession in U.S. market, too.

The level and slope of interest rate also distress corporate bond spread, however, the signs of these variables are ambiguous. Longstaff and Schawartz(1995), Duffee (1998), Collin-Dufresne and Goldsein (2001), Van Lanschoot (2008) showed that credit spreads are robustly negative correlated with the level of interest rate. Nonetheless, Davie (2008) discovered the positive direction in his data set. For the slope of interest rate, he hinted that a shallow (steep) slope imply weaker (stronger) economic activities, decrease (increase) in firm's prospect and increase (decrease) default risk. This implied a higher (lower) yield on corporate bond and lead spread to widening (tighten). Van Lanschoot (2008) explored a significant result in both Euro and U.S. markets as well.

Above and beyond the previous credit spread determinants, liquidity is also a key factor to influence corporate bond spread. In liquidity preference's theory, we know that bond holders usually require liquidity premium when invest in corporate bond. In case of investing in illiquid bond, investors will require more compensation in the spread. Although this variable is crucial, it is difficult to directly observe and also has so many representatives. Furthermore, this variable might detect from bond's demand and supply. For the demand side, Campbell and Taksler (2003) used the 30-day Eurodollar Treasury as the proxy for market liquidity and found the strong positive relationship with the yield spreads. For the supply side, they used the amount of bond issued by each firms in terms of logarithmic form as a proxy for this variable. However, the alternative way is using the difference between bids-ask spread of corporate bond as a substitute like Van Lanschoot (2008) had implemented. He found that this variable is positively significant to corporate bond spread.

For Thai study, Piyakulvorawat (2003) studied the effect of a change in bond rating on stock prices in the stock market and found that bond upgrading and downgrading announced by TRIS rating are associated with significant abnormal stock return. Her result was in line with the finding of Hand, Holthausen and Leftwick (1992), nevertheless, it contradicted with the finding of Dichev and Piotroski (2001), who found no reliable abnormal return following upgrade in U.S. market.

For the credit spread study in Thai market, Putpongpithak (2004) found that the return on SET index, the changes in bond trading volume had no impact on credit spread changes. However, she found that the change in leverage ratio, the change in manufacturing production index (MPI) and interest rate level could explain the changes in credit spread. Note that her finding showed the signs of the coefficients of interest rate level and slope variables were positive, which contrast with most of the result in U.S. market. Besides, FitzPatrick (2006) found that structural credit risk models in the Thai market underestimates credit spreads.

By the way, Khanthavit (2007) studied about the model to price SET 50 index option in Thai market. He used maximum likelihood method and found that SET50 index motion was

best explain by GARCH (1,1) model when compare with other motions (Geometric Brownian Motion, Constant Elasticity of Variance, Jump Diffusion and Stochastic Volatility).

III. METHODOLOGY

In this study, we will employ panel data regression that Campbell and Taksler (2003) had used in U.S. market in order to estimate the relationship between corporate bond yield spread and other deterministic variables. The advantage of this methodology is that it could measure the causes of deviation, across companies and over time. Nonetheless, it used a relatively unstructured econometric approach.

The deterministic variables in this approach can divide into 4 major groups and each group also has explanatory variables as follows.

1. Macro economic and bond specific variables (*MC*). In this group, explanatory variables in macro economic factors consist of the level and slope of interest rate, the market liquidity and the growth rate of Thai economy. For bond specific variables, they comprise of time to maturity, coupon rate, issue size and type of industry (Financial or non financial). When the issuing firm was in financial sector, the financial dummy variable will equal to one.
2. Credit rating variables (*CR*). In this group, we used 2 dummy variables and divided credit rating into 3 groups, which are the bond with credit rating above A, bond with credit rating A and bond with credit rating below A. The 2 dummy variables define as *ABOVE* and *BELOW*. If the corporate bond has credit rating AA to AAA, the *ABOVE* dummy variable will be one, while the *BELOW* dummy variable will be zero. When the bond was unrated or has credit rating B-BBB, the *ABOVE* dummy variable will be zero, while the *BELOW* dummy variable will be one. Note that the corporate bond with credit rating A in this paper refers to the bond with credit rating A-, A, or A+, and if the bond was categorized in these ratings, both dummy variable will be zero.
3. Equity volatility variables (*EQ*). In this group, explanatory variables consist of the stock volatility, the market volatility, the stock average excess return and the average

market return. All variables in this group were computed based on the daily data 180 days previous of corporate bond trading transactions.

4. Financial ratio variables (*FNR*). In this group, explanatory variables are the interest coverage ratio, the operating profit margin, the long-term debt to asset ratio and the total debt to market cap of equity. Note that for companies in financial sector, interest coverage ratio and the operating profit margin are dropped since their interest expenses seem to be their cost of goods sold, which do not reflect the financing cost like in non-financial sector.

The expectation sign and supporting reasons of each explanatory variable, which implement in this study, are summarized in table I as follows;

[Table I is here]

Due to the fact that corporate bond yield spread is the different between corporate bond yield and the closest government bond yield, therefore, investors could create synthetic portfolio that long position in credit spread by long corporate bond altogether with short closest government bond. From Merton (1974) approach of valuing corporate bond, this long position in credit spread will be the same as they remain only short put option on firm's value since the position of long and short of government bond will be net off. Because interest rate has negative impact to European put option, thus, the long position in credit spread will increase when interest rate rises. Remarkably, Putpongpitak (2004) found the positive direction between the interest rate level and the changes in credit spread in Thailand. Davies (2008) also found the same way in U.S. market. In reality, however, when interest rate increases, it also affects other factors such as firm's value and firm's volatility, which alter the value of put option. Therefore, relation of interest rate and credit spread may not have an impact or even be negative as most researchers such as Longstaff and Schawartz(1995), Duffee (1998), Collin-Dufresne and Goldsein (2001), Campbell and Taksler (2003), Van Lanschoot (2008) found in U.S. and Euro market.

For the slope of interest rate, Davie (2008) claimed that this variable could reflect an expectation of future risk free rate. When the slope is flattening (steepening), it implies weaker

(stronger) economic is going to happen, therefore, credit spreads increase (decrease). Unlike U.S. market, Putpongpitak (2004) discovered that relationship between credit spread and slope of yield curve are positive in Thailand.

When the liquidity in the money market is high (more demand), the short term interest rate is low, and the credit spreads are normally tight. On the other hand, when the market liquidity is scarce (low demand), short term interest rate is increasing, whereby the credit spread is widening. Campbell and Taksler (2003) used 30-day Eurodollar treasury as a proxy for this variable and also stumbled on that evidence. Except demand in the market, liquidity could estimate from the supply side, which shows from the size of issuing bond. Generally, when the supply is high (low), the price of products will decrease (increase), and leads corporate bond spread to decline (increase). Nevertheless, most corporate bonds, which have large size, normally issue by big companies and those bond usually have more liquidity in the market, hence corporate bond yield spread from these bonds might decrease. Campbell and Taksler (2003) and Tsuji (2005) also used the amount of bond issued by each corporate in terms of natural log to stand-in this cross-sectional difference in corporate bond liquidity.

By the way, Elton et al (2001) and Campbell and Taksler (2003) argued that coupon rate proxies for the tax effect in U.S. market, which have different tax rate in state and local tax, the Thai tax rate of investing in bond are the same. So, this idea may not be useful in this country. However, the suggestion of Tsuji (2005) that viewed coupon rate as the indicator for investor's preference might be applicable. As coupon rate and time to maturity reflect the duration of the corporate bond, incorporate these variables in the model could provide some interesting information to explain credit spreads.

In favor of the prospect economy, Davies (2008) recommended that the raise of production tend to increase asset value and go ahead to increase recovery rate. Thus, this variable should have negative relationship with the yield spread. Putpongpithak (2004) also used manufacturing production index to proxy this variable and found a significant negative relationship between MPI and changes in corporate bond yield spread. Include this variable in our model will confirm whether her finding is still hold or not.

Campbell and Taksler (2003) and Van Lanschoot (2008) uncovered that financial sector bonds have more yield spread than industrial sector bonds in U.S. and Euro market. However, due to the fact that Thailand has a bank based system and just past financial crisis, most survived bank still strong, therefore, account for this financial sector dummy variable will show whether the result in Thailand will be the same as U.S. and Euro market or not.

Basically, the bonds with high grade quality usually have less spread when compare with the low grade bonds since the rating show the possibility of default that rating agency review and announce to the public. Hence this variable will provide useful information to credit spread. Nonetheless, only credit rating may be rather blurred because only the rating agencies know the exactly model inside. As a result, I will include the financial ratio variables such as interest coverage ratio, operating profit margin, the long-term debt to asset ratio and the total debt to market capitalization of equity in the regression as suggested by Campbell and Taksler (2003). In his finding, he found that incorporate these ratios improved the explanatory power. From corporate finance theory, the first 2 ratios will have negative impact to probability of default, while the last 2 ratios, which reflect firm's leverage level, will have positive relation.

For the return of each stock, Longstaff and Schawartz (1995) found that ROA or ROE of the firms have negative relationship with credit spread. Similarly, Campbell and Taksler (2003) found a significant support as well. This resulted from the fact that the increasing in average return of stock will reduce the leverage position of the firms and leads to lower probability of default. Therefore, the corporate bond spread will be squeezed. On behalf of market return, Lamdin (2003), Campbell and Taksler (2003), Davies (2008) and VanLanschoot (2008) found the solid result that market return has inverse relationship with credit spread since this variable could proxy for the outlook of the economy. Nonetheless, Putpongpithak (2004) did not find the noteworthy conclusion in this variable in Thai market. Therefore, incorporate this variable in this paper could add more contribution to this area of study.

Regarding the stock volatility, this variable could determine the firm's volatility and have positive relation as suggested by Merton (1974), hence we expect this variable to have

positive correlation with the corporate bond spread. Campbell and Taksler (2003) and Bednarek (2006) also confirmed this inspiration. Likewise, market volatility could also explain credit spreads with the same direction as in the finding of Elton et al (2001), Bednarek (2006) and VanLanschoot (2008). On the contrary, Campbell and Taksler (2003) do not find the significant impact of market volatility to the spread, and Bewley et al (2004) even find the negative relationship.

According to the objective of this paper, we will determine whether equity volatility variable could determine the corporate bond yield spread or not. Furthermore, whether including these group variables in the model, they could increase the explanatory power or not. In order to find the result in a systematic way, we will do the step of panel data regression as follows.

1. We pooled all panel data by treating each bond trading transaction as an independent observations and run ordinary least square (OLS) regression in order to estimate the relationship between corporate bond yield spread and other deterministic group of variables. All regressions also include 11 month dummies (January through November) with the purpose of control time series variation. Recall that financial ratio variables of financial sector are difference from non-financial sector in term of no interest coverage ratio and the operating profit margin, therefore, we have to separate data between these 2 industries before running OLS regression. Number of function as follow showed the group of independent variables in each OLS model.

$$Spread = f(MC) \quad (4)$$

$$Spread = f(CR, MC) \quad (5)$$

$$Spread = f(EQ, MC) \quad (6)$$

$$Spread = f(EQ, CR, MC) \quad (7)$$

$$Spread = f(EQ, CR, FNR, MC) \quad (8.1) \text{ Non financial sector}$$

$$Spread = f(EQ, CR, FNR, MC) \quad (8.2) \text{ Financial sector}$$

2. After that, we will use those independent variables to estimate fixed effect regression for each bond issuer. This method has a purpose of removing the pure cross-sectional variation of each firm and find the within relationship between corporate bond yield spread and equity volatility and other deterministic variables in the same issuing firm. In addition, we will replace the 11 month dummies (January through November) with 89 month dummies (July 2001 until November 2008) in order to remove the time series variation in average yields. In case that financial ratio variables influence corporate bond yield altogether with other deterministic variables, separate fixed effect regressions for financial sector and non-financial sector also required.
3. From Gujarati and Porter (2009) dummy variable econometric approach, we will consider the interaction effect to examine whether during the bear market period (After 29 Oct 2007) in the period of study (2 July 2001 through 30 Dec 08), the corporate bond yield spreads increase or not. If the spreads increase significantly during that period, the bear market dummy variable (*BMDV*) that defines as 1 when the data were in the period of bear market will be positive. Furthermore, we also determine whether the slope coefficients of those explanatory variables during that recession period alter or not. Hence, there are 4 possibility events to occur, which are coincident (unchanged in both intercept term and slope), parallel (change only in intercept term), concurrent (change only in slope) and dissimilar (both change in intercept term and slope) regressions.
4. Last, but not least, we will alter the stock volatility, which proxy from the standard deviation of excess return from market-adjusted-model by Campbell et al (1997), to the standard deviation of stock volatility, which estimated from GARCH (1,1) in market model instead. Then, we will rerun the regressions as in the previous 2 steps above with the aim for robustness checks and also compare the explanatory power with the previous volatility. Note that the regression

number when apply GARCH (1,1) in function above will follow by alphabet "A" in order to make it different.

IV. DATA

The corporate bond data used in this study were obtained from i-bond database of Thai Bond Market Association (ThaiBMA) during 2 July 2001 until 30 Dec 2008. We choose data between that period in order to cover the most recent period as well as obtain as much as possible data set since corporate bond market in Thailand is quite illiquid and have low trading transactions. Furthermore, this period of study could cover both bull (2 July 01 until 29 Oct 2007) and bear (30 Oct 2007 until 30 Dec 08) in stock market. (SET index peak at 915.03 point at 29 Oct 2007, as presented in figure 3).

[Figure 3 is here]

For data screening, in the first step, we eliminate the corporate bond that the issuing firm did not listed in Stock Exchange of Thailand (SET) during the period of study. Then, due to our focus on fixed rate straight bond as follow from Campbell and Taksler (2003), we cut the amortization bond, floating coupon bond and bond with embedded option out of the data set. Next, we get rid off the secured bonds of the data set since our model rely on only the firm's default risk, not the recovery rate from the asset secured or guarantor. After doing this step, we remain 6,291 observations out of 12,342 observations. However, as some firms during the period of study have infrequently trading transactions (less than 10 transactions during past 7.5 years), therefore, we delete those firms' data out of our data set and remain only 6,241 observations. In this data, it contains 8 issuing firms in financial sector (1,536 observations) and 24 issuing firms in non-financial sector (4,705 observations).

Other bond information such as coupon rate, time to maturity, issue size, credit rating of each corporate bond will also derive from i-bond database. For the corporate bond yield spread, which is the dependent variable in the model, we will employ the static spread of each bond that this site had provided. This spread was calculated from the difference of corporate bond yield and the closest government bond yield based on duration. Furthermore, due to the fact that Thai bonds normally rated either by TRIS or Fitch (Thailand) rating agencies,

therefore, we will transform both rating to be the same. For example, bond that rated by Fitch (Thailand) with symbol AA (tha) will equivalent to the symbol AA of TRIS rating. In case that the bond was rated by both agencies; we will use the lower rate for conservative purpose. Average corporate bond yield spreads are showing in table II as follows;

[Table II is here]

From table II above, almost (68.71%) corporate bond trading transactions are in short maturity term (Less than 3 years), while 25.12% and 6.17% are in medium (Between 3-7 years) and long maturity (More than 7 years). The average credit spread for short maturity bonds are precisely in sequence as our belief that the bond with high rating will have lower spread. Nevertheless, the medium term and long term is not obvious. In terms of sector dimension, we will see that in the short maturity bond, financial sector has lower spread, however, in the medium term bond, the opposite direction occur. Surprisingly, there is no observation of corporate bonds, which categorized in financial sector or in credit rating below A in long maturity term. Additionally, for corporate bond trading transactions in each year, we found that the transaction is growing very fast (Over 10 times during the past 8 years). Total bond trading during the past 3 years (2006-2008) were over 1,000 transactions.

With reference to the proxy of interest rate level and slope, we used the closest government bond yield based on duration of each bond trading transactions and the difference between 10 years treasury yield and 2 years Treasury yield as the substitute. Also, we used 1 month T-bill as an alternative to capture money market liquidity from the demand side in the model. All of these data will get from i-bond database as well.

For the stock price data, we collect individual stock price, its dividend per share and SET index from DATASTREAM database during the same period. The rate of return, which used to estimate equity volatility (*EQ*) variable, was calculated from daily return assuming continuous compounding rate. After we got daily return of each stock and market return, we will calculate daily excess return of each stock by using the different of each stock return and market return. This method called *market-adjusted-model* proposed by Campbell et al (1997). In this methodology, it was the same as we impose beta of one and alpha of zero in the market

model. Afterward, we calculate the mean and standard deviation of the stock's daily excess return preceding 180 days of each bond trading transactions. These 2 variables are the proxy for stock average return and stock volatility in the equity volatility variable group. Likewise, we calculate the mean and standard deviation of market return preceding 180 days of each bond trading transaction in order to capture average market return and market volatility, respectively. In addition, we bring daily stock return of each stock along with daily market return and run OLS regression in market model as follows;

$$r_{i,t} = \alpha + \beta r_{m,t} + \varepsilon_{i,t} \qquad (9)$$

Where, $r_{i,t}$ = Daily stock return of stock i at day t.

$r_{m,t}$= Daily market return at day t.

$\varepsilon_{i,t}$ = Residual which has GARCH(1,1) process of stock i at day t.

Then, we had used LM test to detect autoregressive conditional heteroscedasticity (ARCH) effect in the model. Once the model exist ARCH effect, we will estimate volatility in GARCH (1,1) model by using maximum likelihood method. The equation for GARCH (1,1) showed below;

$$\sigma_{i,t}^2 = \omega + \delta\sigma_{i,t-1}^2 + \upsilon\varepsilon_{i,t-1}^2 \qquad (10)$$

Where, $\sigma_{i,t}^2$ = Current variance of return of stock i at day t.

$\sigma_{i,t-1}^2$ = 1st Lag variance of return of stock i at day t.

$\varepsilon_{i,t-1}^2$ = 1st Lag variance of residual term of stock i at day t.

After we got the parameters ω, δ and υ, which reflect the intercept term and order p, q of GARCH (1,1) model from STATA program, we will use these parameters to predict the new variance of each stock, which estimated from GARCH (1,1) model, in all day of trading transaction. (See all parameter value in appendix). Then, we will take a square root of those estimated variance in order to get the standard deviation, which estimated from the variance of GARCH (1,1) model. This standard deviation will be the alternative of stock volatility for robustness check in the model. Note that variance, which estimate from GARCH (1,1) model,

will incorporate the most recent innovation (ε_{t-1}^2) and the most recent variance (σ_{t-1}^2) in the model. Therefore, this volatility might capture the most recent information sooner than the previous standard deviation of the stock's daily excess return preceding 180 days.

Besides, the key financial ratios of each issuing firm like interest coverage (EBIT/Interest expenses), operating profit margin (EBIT/Sales), long term debt to asset (Long term Debt/ Total asset) and total debt to capitalization (Total debt/Market cap of equity), will collect from raw accounting information that SETSMART database provided. The financial statements that we used here are the half year financial statement (Jan-Jun) and full year financial statement (Jan-Dec) based on calendar year. From this practice, all 32 firms have the same calendar year. To allow the most recent data update altogether with the financial information exposes to investors, we divide the period of data collection as follows. During January through March of each year, we will use the half year financial report of the previous year. Next, between April and September of each year, we will use the full year financial report of the previous year. Then, during October to December of each year, we will use the half year financial report of that year.

For the rest of deterministic variable, which is the proxy of Thai economy growth, we will employ the growth rate of manufacturing production index (MPI) as suggested by Putpongpithak (2004), who found a significant negative relationship with changes in credit spread in Thai market. Note that MPI data set exposes as monthly data from Bank of Thailand (BOT), hence, in order to ensure that investor will recognize this data, we will use the MPI prior 60 days of each corporate bond trading transaction.

Next, the descriptive statistics of all variables will show in table III. Then table IV will show the mean and standard deviation of some key variables within the same firm such as corporate bond spread, volatility, stock return and financial ratios. After that, table V will show correlation of each variable without financial ratio, which used in OLS (4) to (7). Then, table VI will demonstrate the correlation when including financial ratio for non financial firms, which used in OLS (8.1) and lastly, table VII will illustrate the correlation among variables for financial firms, which used in OLS (8.2).

[Table III is here]

From table III, we will see that except average daily excess return (*RI*), the rest explanatory variables have positive mean. Furthermore, almost variables apart from credit rating dummy variable above A are not normally distributed. In addition, some variables such as S.D. of GARCH (1,1), dummy variable credit rating below A, and interest coverage ratio have positive skewed and fat-tailed distribution.

When we sort the key statistics within the same firms as shown in table IV, we find that TPC has the most yield spread and volatility (Both *SI* and *SDG)*, however it has the highest average daily excess return (*RI*) as well. This result indicates high risk, high return for this stock. For financial ratios of each firm, LH has the most debt service ability, while PTTEP has the most operating profit margin. In terms of leverage position, we find that TCAP is the most.

[Table IV is here]

Next, we will consider the correlation of each variable. Table V, VI, and VII show the correlation matrix of each case. In the first case, table V shows the correlation between all variables, which will use in OLS (4) to (7). For the second case, table VI shows the correlation between variables, which include 4 financial ratios that use in OLS (8.1) for non financial firms. Lastly, table VII shows the correlation between variables, which include 2 financial ratios of financial sector that will use in OLS (8.2). From those correlations in all matrixes, we find that the correlation between closest government bond yield (*GY*) and 1-Month treasury yield (*TB*) are quite high at 0.8348, 0.8209 and 0.874 respectively. Since multicollinearity problem might occur from those 2 close related independent variables, hence, we need to drop *TB* out of the model to avoid that problem.

[Table V is here]

[Table VI is here]

[Table VII is here]

V. EMPIRICAL RESULT

After pursue the method of study above, we get the empirical evidences in the tables as follows;

Table VIII shows the (OLS) regressions of the pooled panel data, which explain the relationship between spread and other independent variable in each group. Note that when include financial ratio group (*FNR*) in the regression, the number of observations will reduce. Data of firms within financial sector was less than non financial sector. All regressions will firstly base on macro economic and bond specific group of variables (*MC*), and then will follow add other groups (*CR*, *EQ* and *FNR*) in the regressions.

[Table VIII is here]

From table VIII in regression (4) to (5), we find that except for coupon rate, the rest explanatory variables in *MC* and *CR* group could explain the corporate bond yield spread significantly with the confidence level of 99.9%. All signs of determinant variables in *MC* group are the same for both regression, however, regression (5) is better explain the credit spread than regression (4) since its adjusted R-square is higher at 26%. This result was in line with our expectation because add credit rating variables in the model could expose the creditworthiness of each firm that macroeconomic variable could not capture. Sign of both credit rating dummy variable also consistency with our expectation since firm with credit rating above A has lower credit spread, while firm with credit rating below A has higher credit spread when compare with the firm with credit rating A. For the sign of independent variables in *MC* group, we find that time to maturity and growth of MPI, are also in line with our expectation. Next, we find that the corporate bonds, which have large issuing size, will have lower spread. This resulted from the fact that firms, which could issue large size of bond, are normally had larger sales and assets than the others. Hence, their default risk is smaller. Moreover, we discover that the closest government bond yield, which represent for the level of interest rate, has negative sign that in line with the theory of Longstaff and Schawartz (1995). On the other hand, we find a positive sign for the slope of interest rate, which using the difference between 10 years and 2 years government bond yield as a proxy. This result was contradicted to the finding of Campbell and Taksler (2003), Davies (2008) and Van Lanschoot (2008) in U.S market and Euro market, but similar to the previous finding of Putpongpithak (2004) in Thai market. Additionally, we get the negative relationship between

corporate bond yield spread and financial sector dummy variable, which indicated that the firms within financial sector has lower yield spread than firms within non-financial sector.

Next, in order to answer the question that whether the equity volatility (*EQ*) group could explain the corporate bond yield spread as much as credit rating (*CR*) group or not as Campbell and Taksler (2003) finding in U.S. market, we replace the equity volatility (*EQ*) group instead of credit rating (*CR*) group in the regression as showed in (6). In this regression, we find that the equity volatility (*EQ*) group could explain the corporate bond yield spreads over the credit rating (*CR*) group because its adjusted R-squared is 31%, which greater than the adjusted R-squared in (5). Note that all variables in *EQ* group like firms' volatility and firm's excess return, market's return and volatility are strongly explain corporate bond yield spread with confidence level of 99.9% as well. This finding was different from the empirical evidence of Campbell and Taksler (2003) in U.S. market that found the market volatility did not explain corporate bond yield spread. Interestingly, we find that when include *EQ* group in the model, the level of interest rate, which represent from the closest government bond yield, have turn around from negative to positive sign. The reason behind might derived from Black, Scholes and Merton's model in equation (3), which we understand that when govern other variables like volatility and time to maturity to be constant, interest rate level will have negative relationship with put option on firm value and leads corporate bond yield spread to enlarge. This finding is consistence with the result of Putpongpithak (2004). Additionally, the growth rate of economy, which represent from growth of MPI, is no longer explain the corporate bond yield spread. One reason to explain is that the average market return and volatility might capture from the impact of interest rate and prospect of economy already. Signs of the rest variables are the same as previous regression (4).

Then, we include *MC, CR* and *EQ* groups altogether as in function (7). We get that this regression has the highest adjusted R-squared at 37% for full sample data. This means that all of variables in each group could provide additional information to explain corporate bond yield spreads. Similar to (6), growth of MPI is insignificant to explain corporate bond yield spread. Nevertheless, we find that the coupon rate variable is now significant at 95%

confidence level. The sign of this variable is positive, which may result from tax expenses consideration or investor risk preference. Interestingly, after run these 4 regressions, we find that all signs of significant independent variables are consistence.

In regression (8.1) and (8.2), next, we include the financial ratio (*FNR*) group in the model. Note that we separate the data into 2 groups and dropped the financial sector dummy variable before running both regressions since the firms in financial sector do not have some ratios like interest coverage ratio and operating profit margin as in non financial sector. For regression (8.1), which we used non-financial firms data set and include all 4 financial ratios, we find that except for the growth of MPI, the remain independent variables could explain corporate bond yield spread by at least 95% confidence level. Sign of *EQ*, *CR* and *MC* also similar to regression (7). However, for the sign of interest coverage ratio in *FNR* group, it did not in sequence with the theory, which suggested that when firm have high debt service ability, chance of default will reduce and yield spread will decline. We still have the puzzle from this result and do not have appropriate reasons to clarify. Nonetheless, other sign of key financial ratios such as operating profit margin, long-term debt to asset ratio and total debt to capitalization still in line with the theory with confidence level over 99%.

In case of explaining corporate bond yield spread of financial firms that we used OLS regression (8.2) to determine, we find that all independent variables in *EQ* group are the same as previous finding (4) to (8.1). This result had strengthened our hypothesis that both volatility and return of individual firm and market could determine the corporate bond yield spread. In this regression, however, we find that credit rating dummy variable above A is oppose from our expectation. The reason behind might due to our data that we have only 1 company (KTB), which has credit rating above A and merely has 53 observations in financial sector data set.

Also, we discover that the sign of total debt to capitalization ratio is negative, which different from the normal expectation. Nevertheless, due to the fact that financial companies in banking industry might have more deposit, which mostly categorized as current liability, therefore, their total debt to capitalization ratio will increase. This kind of event did not

increase more default risk to the bank, but even decrease this risk since banks will have more liquidity to service other debts and these deposits are still fully guaranteed by the Bank of Thailand. Hence, corporate bond yield spreads of those banks could decline. For signs of other variables in *MC*, they are similar to prior regression (4) - (8.1).

Subsequently, in order to estimate the within relationship between corporate bond yields and other independent variables for the same issuer, we will apply fixed effect regression to estimate. We have run several regressions between corporate bond yield spread and other deterministic variables in each group, however, we will report the results based on function (7) for overall sample, function (8.1) for firms within non-financial sector and (8.2) for firms within financial sector in table IX as follows.

[Table IX is here]

As showed in the table IX in odd columns, which include 11 months dummy variables in the fixed effect regressions, we find that all independent variables in equity volatility variable group (*EQ*) are statistically significant to explain the corporate bond yield spread with confidence level at least 99%. Signs of those variables are also similar to the result in previous OLS regressions and consistence with our expectation. However, sign of issue size variable turnaround from negative to positive. This result occurs since within the same company, the bond series that have larger issue size will have more products supply in the market. Therefore, its price will be cheaper and its yield will be higher that leads the spread to widen.

One possible opposition in the fixed effect regressions with 11 month dummies is that it may gather up the time series variation in the data. Therefore, we will replace those 11 month dummies (January through November) by 89 months dummies (July 2001 through December 2008) in order to remove the time series variation as showed in even columns of table IX. From the result, we find that time series variation is matter to explain corporate bond yield spread. When replace the seasonal dummies (January through November) with monthly time dummies (July 2001 through December 2008), we find that market return is no longer statistically significant to explain corporate bond yield spread within the same issuers in all 3 data sets (overall, non-financial and financial samples). Nevertheless, the average daily excess

returns of each stock, firm-level volatility and market volatility still important to determine corporate bond yield spread for full sample data with signs that in line with the theory. However, when considered the data of non-financial firm, we find that only market volatility in *EQ* was noteworthy to describe credit spread. On the other hand, when reconsidered to the data of financial firms, we find that only excess return's volatility in *EQ* was significant to determine spread. This result confirms that stock volatility is matter to explain corporate bond yield spread across time within the same company. Additionally, for variables in other groups, we find that the sign of the closest government bond yield in all 3 samples had turnaround from positive to negative. This result were conflicted with the finding of Campbell and Taksler (2003), who find the same negative sign when remove changes in time series. Furthermore, the slope of interest rate is no longer explaining the spread for all 3 data sets.

Then, we consider the interaction effect by including the bear market period dummy variable (*BMDV*) in the previous OLS regression based on function (7) for overall sample, function (8.1) for firms within non-financial sector and (8.2) for firms within financial sector. Besides, due to the fact that we do not know whether slope of each group variables (*EQ, CR, MC* or *FNR*) will alter during bear market period or not, therefore, we will multiply bear market dummy variable (*BMDV)* with all independent variables to detect slope drifter. Result of this interaction effect was demonstrated in Table X.

[Table X is here]

From table X, we discover that there exist concurrent event for full sample regression (7) and non financial sector sample regression (8.1) since only slope parameters of both regressions had been changed significantly. However, for financial sample regression (8.2), we find the dissimilar event occur because both intercept term and slope parameters had altered significantly. Furthermore, we come across that during bull market period; market return is insignificant to explain corporate bond yield spread, while other variables in *EQ* could mainly explain for overall sample data as stated in (7). Nevertheless, in the meantime of bear market, both market volatility and return will become more important to determine the spread with positive direction. Hence, the sign of combine coefficient of market return during

bear market period will be positive, which contradict with the theory. For *CR* group, we discover that both sign of dummy variables are in line with the theory during bull market. However, the sign of credit rating below A in bear market positive was negative, which means the spread of low grade bond is decreasing. This result might occur from investors switch their assets from stocks to corporate bonds and lead spread to decline during bear market. About *MC* group, we find that all variables could explain the corporate bond yield spread during bull market period significantly with the same sign as OLS regression (7) in table VIII. During bear market period, however, we find that most sign in *MC* have flipped except for only time to maturity and coupon rate variables. Magnitude of coefficient in *MC* group except for financial sector dummy variable during bear market period is greater than during bull market period. Hence, we find the strong evidences of economy structural changes between bull and bear market since corporate bond spread that determine from those macroeconomic variables act differently. Furthermore, the positive sign of financial sector dummy variables during bear market period indicates that corporate bond yield spread of firms within financial sector is increasing during bear market period, caused by sub-prime crisis.

For interaction effect regression in (8.1) that using data of non-financial firms, we also find that except for market return, the rest variables in *EQ* are significant to explain spread during bull market period. Nevertheless, when turnaround to bear market period, we discover that apart from the firm's volatility, the rest parameters have changed significantly with positive sign. Both merge coefficient of firms' volatility and market volatility during bear market period still consistence with the theory with positive direction to credit spread. However, the total coefficient of stock return and market return are contrast with our expectation since both sign become positive during bear market period. Moreover, when we look at the credit rating dummy variable in both below A and above A during bear market period, we find that their sign are negative. This finding confirms that both low grade and high grade bonds have lower spread during the bear market period. This resulted from the fact that investors move from risky asset to more safety asset during bear market period. Additionally, for *FNR* group, we find that during bull market period, total debt to capitalization is

insignificant to explain corporate bond yield spread for non-financial firms. However, in the meantime of bear market period, this ratio is now positively significant to explain credit spread. Also, total sign of interest coverage ratio during bear market period was negative, which in line with the theory. Note that sign of operating profit margin during bear market period was positive, which leads the combine coefficient of this variable to be smaller negative during bear market period. This indicated that investors did not so concern about firm's profitability to let firms survive during bear market period as in bull market.

Then, we reconsider for the interaction effect of firm within financial sector as stated in (8.2). In this regression, we found that only *EQ* and *MC* group variable have slope drifter, while *CR* and *FNR* group remain the same for both bull and bear market period and their sign also similar to previous OLS regression (8.2) in table VIII. Although firm's volatility and market return in *EQ* group are significance to describe corporate bond yield spread during bull market period, only the sign of excess return's volatility was in line with the theory, while another variable opposed to the theory. We still have a puzzle on this result and do not have appropriate answer to clarify yet. When bear market period occur, market volatility is also significantly to explain the spread with positive sign. For *MC* group, we find that sign of interest rate level, slope of yield curve and issue size are turnaround during bear market period as well. However, time to maturity variable still have positive direction in both bull and bear market period, which in line with the theory. Furthermore, the intercept term of *BMDV* is positively significant, which confirms that corporate bond yield spread for firms within financial sector is widening during bear market period. This result might occur from the fact that investors have more concern with the credit risk of financial firms due to sub prime crisis and the bankruptcy of Lehman Brother Co.,Ltd in U.S. market that may infect around the world.

Next, we will substitute the standard deviation of firm's volatility, which estimate from GARCH (1,1), instead of the standard deviation of daily excess return prior 180 days of bond trading transaction for robustness check. Table XI shows the OLS regression to explain corporate bond yield spread and table XII shows the issuer fixed effect as follows;

[Table XI is here]

[Table XII is here]

Empirical evidences in table XI of regression (6A) and (7A) for full sample confirm that all variables in equity volatility group (*EQ*) could explain the corporate bond yield spreads. Furthermore, when compare adjusted R-squared of regression (6A), which has *EQ* and *MC* as independent variables, with regression (5) in table VIII, which have *CR* and *MC* as independent variables, could strengthen the finding that equity volatility variables could determine corporate bond yield spread over credit rating variables. Also, when incorporated *EQ, CR* and *MC* group altogether, those independent variables could better explain corporate bond yield spread since adjusted R-squared in (7A) is greater than (6A).

Nevertheless, when incorporate variables in financial ratio group (*FNR*) in the model, we discover that average daily excess return of individual stock is no longer explain the corporate bond yield spread for both non financial sector and financial sector data set. Note that sign of all independent variables in table XI are the same as table VIII.

Moreover, when using fixed effect regression to explain the within relationship of corporate bond yield spread and the equity volatility of the same issuers as illustrates in table XII, we find that all variables in *EQ* group could determine corporate bond yield spread for total observations and firms within financial sector data set. However, for non financial sector data set, we find that the standard deviation of GARCH (1,1) is insignificant to clarify corporate bond yield spread. When replace 11 month dummies to 89 month dummies to remove time series variation for overall sample, we find that both standard deviation of GARCH (1,1) and market volatility could still determine the corporate bond yield spread of full sample data. Nevertheless, for non financial sector data set, we remain only market volatility in *EQ* group that could explain corporate bond yield spread of the same issuing firms. In case of firms within financial sector, we discover that average daily excess return on stock was statistically significance to explain corporate bond yield spread, but with wrong expected sign. We still have the puzzle on this finding, but, all signs of independent variables in table XII are similar to table IX.

VI. CONCLUSION

In this study, we employ an unstructured econometric approach of panel data regression, which proposed by Campbell and Taksler (2003), in order to detect the relationship between corporate bond yields spread and stock volatility and other deterministic variables such as macro economic variables, credit rating and financial ratios in Thailand. Our result indicates that equity volatility in both firm-level specific risk and market risk is matter to explain the corporate bond yield spreads across companies, and across time for overall sample. Furthermore, we find that the increasing of interest rate level and slope leads corporate bond yield spread to widen, which in line with the result of Putpongpithak (2004) in Thai market. However, in contrast with her finding, we find that the market return was statistically significant to explain the corporate bond yield spread with negative sign and the growth of MPI is no longer explain the spread. In addition, our finding also confirm that during the bear market period, corporate bond yield spreads for financial firms are widening and dissimilar event occur. However, for non financial sector, we find only concurrent event.

Notwithstanding, our paper proposed the S.D. of GARCH (1,1) to proxy individual stock volatility instead of S.D. of daily excess return, we find that this variable could determine corporate bond yield spread as well. Hence, this finding provides strong empirical evidence that individual stock volatility is matter to explain corporate bond yield spread since stock volatility from both measures have an explanatory power on spread with positive direction. All signs of independent variables also similar in both OLS and fixed effect regressions.

For implication of this study, practitioners could use equity volatility as the deterministic variable to develop the model to forecast changes in corporate bond yield spread. Furthermore, firms could use this relationship to identify relative value opportunities to issue bonds. Likewise, investors may use this relationship to find the stock volatility threshold to detect the timing before investing in bonds.

Although our paper provide the empirical evidence that stock volatility is subject to corporate bond yield spread, future researchers could study more in dept relationship by including the jump risks of individual firms as Zhang et al (2005) employed in U.S. market, or

either incorporate liquidity premium between bid-ask spread as the explanatory variables in the regression as Van Lanschoot (2008). Furthermore, examiners could apply other sophisticated econometric approach to find the precise linkage between stock volatility and corporate bond yield spread in both Thailand and other countries.

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Table I
Summarize of sign expectation and supporting reasons of each explanatory variable

Variable	Sign	Supporting reasons
Equity volatility (*EQ*)		
S.D. of GARCH (1,1) (%)	+	High firm's idiosyncratic risk, high probability of default.
S.D. of daily excess return (%)	+	High firm's idiosyncratic risk, high probability of default.
S.D. of daily SET return (%)	+	High market risk, high probability of default.
Mean daily excess return(%)	-	High growth rate of firm, low probability of default.
Mean daily SET return(%)	-	High market return refer to well economic condition. Hence low chance of firm to default.
Credit ratings (*CR*)		
Above A	-	High grade bond, low probability of default.
Below A	+	Low grade bond, high probability of default.
Financial ratio (*FNR*)		
Interest coverage (times)	-	High debt service ability, low chance to default.
Operating profit margin (times)	-	High profit margin, low chance to default.
Long term debt to assets (times)	+	High debt burden, more financial risk, high chance to default.
Total debt to capitalization (times)	+	High leverage, high chance to default.
Macro economic and other variables (*MC*)		
Closest government bond yield (%)	?	A higher level of interest rate could increase the drift of risk neutral process for firm's value and lower probability of default. (Longstaff and Schawartz,1995) However, an increasing of interest rate could also reduce the value of put option on firm value and widening the spread.
10 yr.-2yr. government bond yield (%)	?	A steeper slope imply an improving of economy in the future, therefore, credit spread might reduce. (Davies,2008) However, it could reflect the forecast of inflation rising as well. Hence, monetary will tighten credit and lead credit spread to increase. (Zhang et al,2003)
1 Month T-bill (%)	+	Low short term interest rate implies high liquidity in the market and more demand to invest, therefore, corporate bond yield spread declines.
Issue size (log)	?	High issuing size could refer to more bond supply in the market, thus, bond value decrease and spread increase. However, more bond size normally issue by big companies and also reflect bond liquidity in the market, so, it could reduce the spread.
Time to maturity (years)	+	Long time to maturity, long time to face with default risk, high credit spread.
Coupon rate(%)	?	High coupon rate,high tax expenses, so, spread increase. Nevertheless, this variable could reflect investor's risk aversion from interest rate raising. An increase (decrease) in investors' risk aversion create a negative (positive) relationship between coupons and spreads.(Tsuji,2005)
Growth of MPI (%)	-	High growh imply high investment in real sector and expansion of economy, therefore, reducing credit spread.
Financial sector or not	?	Financial sector usually have high leverage position and its business was sensitive to the economy, therefore, corporate bond yield spread in this sector might greater than in non-financial sector. However, as Thailand is the bank-based economy and just past the crisis, this sector may have lower spread since many firms still aware on their creditworthyness.

Table II

Average Corporate Bond Yield Spreads

Using data between 2 July 2001 and 30 Dec 2008, we report corporate bond yield spread (basis point) by credit rating and time to maturity. All corporate bond are unsecured, straight fixed coupon rate, and have no embedded option. Number in parenthesis shows amount of transactions.

					Sector	
	Above A	**A**	**Below A**	**Total**	**Financial**	**Non-Financial**
	Panel A: Breakdown by time to maturity					
	64.89	78.40	121.21	81.08	78.20	82.32
Short (Less than 3 years)	(924)	(2,804)	(560)	(4,288)	(1,293)	(2,995)
	92.72	89.52	154.52	96.84	122.02	92.23
Medium (3-7 years)	(908)	(528)	(132)	(1,568)	(243)	(1,325)
	69.29	N/A	N/A	69.29	N/A	69.29
Long (More than 7 years)	(385)	(0)	(0)	(385)	(0)	(385)
	Panel B: Breakdown by year					
	143.42	173.37	120.93	130.18	116.50	130.38
July-Dec 2001	(12)	(19)	(106)	(137)	(2)	(135)
	111.95	103.95	114.83	111.75	112.58	111.65
Jan-Dec 2002	(235)	(75)	(174)	(484)	(50)	(434)
	82.98	81.24	109.07	87.25	97.64	83.15
Jan-Dec 2003	(241)	(239)	(113)	(593)	(168)	(425)
	90.93	118.25	178.29	123.15	138.68	107.61
Jan-Dec 2004	(135)	(204)	(97)	(436)	(218)	(218)
	57.22	74.76	126.96	73.15	71.07	74.82
Jan-Dec 2005	(130)	(352)	(28)	(510)	(227)	(283)
	71.98	78.09	170.79	79.40	72.25	81.80
Jan-Dec 2006	(367)	(638)	(39)	(1,044)	(262)	(782)
	62.58	59.64	139.47	63.24	54.68	65.19
Jan-Dec 2007	(676)	(955)	(51)	(1,682)	(312)	(1,370)
	81.60	93.39	101.50	90.23	88.01	90.85
Jan-Dec 2008	(421)	(850)	(84)	(1,355)	(297)	(1,058)

Table III
Summary statistics (Overall)

Variable	Number	Mean	S.D.	Kurtosis	Skewness
Dependent Variable					
Corporate bond yield spread (*SPREAD*)	6,241	84.3118	54.3418	7.7198	1.5929
Equity volatility					
S.D. of GARCH (1,1) (%) (*SDG*)	6,241	1.8770	0.8361	749.5373	19.6196
S.D. of daily excess return (%) (*SI*)	6,241	1.7296	0.6247	5.9743	1.2834
S.D. of daily SET return (%) (*SM*)	6,241	1.3650	0.4246	3.6951	1.0578
Mean daily excess return(%) (*RI*)	6,241	-0.0002	0.1508	4.5521	0.3564
Mean daily SET return(%) (*RM*)	6,241	0.0036	0.1742	5.7671	-0.9479
Credit ratings					
Above A (*ABOVE*)	6,241	0.3552	0.4786	1.3660	0.6050
Below A (*BELOW*)	6,241	0.0654	0.2472	13.3665	3.5166
Financial ratio					
Interest coverage (times) (*ICR*)	4,705	10.8196	12.0237	47.3473	5.3027
Operating profit margin (times) (*OPM*)	4,705	0.1998	0.1328	4.9322	1.1178
Long term debt to assets (times) (*LDA*)	6,241	0.3829	0.2096	3.4450	1.1620
Total debt to capitalization (times) (*DE*)	6,241	1.7945	2.0286	10.3862	2.2502
Macro economic and other variables					
Closest government bond yield (%) (*GY*)	6,241	3.5976	1.1198	2.2966	-0.2726
10 yr.-2yr. government bond yield (%) (*SY*)	6,241	1.5186	0.9471	2.7957	0.7891
1 Month T-bill (%) (*TB*)	6,241	3.0469	1.1850	2.0849	-0.0452
Issue size (log) (*LNS*)	6,241	8.2022	0.8777	2.6525	-0.4425
Time to maturity (years) (*TTM*)	6,241	2.7599	2.2499	7.8933	1.8685
Coupon rate(%) (*COUPON*)	6,241	5.1522	1.5239	6.0834	1.2690
Growth of MPI (%) (*MPI*)	6,241	0.5934	6.0914	4.3164	-0.7909
Financial sector or not (*FN*)	6,241	0.2461	0.4308	2.3896	1.1788

Table IV
Summary statistics (Sort by Firms)

Stock		*SPREAD*		*SI*		*SDG*		*RI*		*ICR*		*OPM*		*LDA*		*DE*	
Symbol	**Number**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**
AEONTS	97	101.07	36.51	2.48	0.58	2.39	0.84	- 0.04	0.19	.	.	.	.	0.88	0.01	1.76	0.50
ADVANC	1,020	80.93	40.45	1.92	0.29	1.92	0.26	- 0.02	0.14	12.20	4.70	0.28	0.04	0.26	0.09	0.42	0.21
BAY	97	100.94	79.52	2.16	0.63	2.18	0.94	- 0.09	0.09	.	.	.	.	0.15	0.05	4.53	0.71
BECL	20	164.20	73.97	1.88	0.48	1.86	0.58	0.10	0.19	2.49	0.02	0.47	0.01	0.53	0.02	1.86	0.31
BGH	11	83.55	46.06	1.90	0.42	2.66	0.85	- 0.04	0.16	3.64	-	0.14	0.01	0.41	0.03	0.33	0.03
CENT	29	74.07	27.02	1.68	0.29	3.46	0.00	0.03	0.14	7.89	0.97	0.12	0.01	0.30	0.10	0.89	0.12
CK	138	98.58	35.94	2.17	0.63	2.03	0.45	- 0.06	0.12	2.21	1.25	0.12	0.06	0.24	0.07	1.81	0.70
CPF	349	81.59	51.59	1.46	0.28	1.74	0.13	0.02	0.13	3.38	2.59	0.04	0.02	0.18	0.02	1.52	0.32
CPN	43	59.56	21.78	2.24	0.34	2.94	1.13	0.02	0.13	5.07	0.95	0.43	0.08	0.51	0.03	0.45	0.06
EASTW	100	98.94	34.76	2.15	1.04	2.17	0.50	0.07	0.17	4.89	1.60	0.53	0.12	0.41	0.08	0.88	0.13
HMPRO	28	110.18	49.80	1.76	0.33	1.85	0.66	0.07	0.14	8.83	4.23	0.06	0.01	0.21	0.06	0.93	0.21
ITD	49	160.27	27.50	3.17	0.49	2.74	0.50	- 0.02	0.13	1.26	1.45	0.03	0.03	0.16	0.04	1.48	0.11
KK	349	93.13	55.55	1.76	0.36	1.95	0.52	- 0.04	0.09	.	.	.	.	0.44	0.24	3.46	1.15
KTB	53	45.68	10.74	1.48	0.14	1.50	0.20	- 0.02	0.11	.	.	.	.	0.10	0.02	9.03	0.77
KTC	618	75.54	42.14	1.89	0.69	1.89	0.67	0.02	0.19	.	.	.	.	0.81	0.06	4.13	1.69
LH	160	116.93	67.61	1.99	0.30	2.02	0.25	- 0.03	0.12	46.70	32.51	0.32	0.09	0.24	0.04	0.25	0.07
MBK	23	92.17	54.67	1.85	0.34	1.35	0.43	0.11	0.11	16.39	1.90	0.40	0.03	0.27	0.04	0.72	0.05
NMG	79	184.03	55.57	1.98	0.32	1.94	0.54	- 0.07	0.12	0.92	1.43	0.09	0.13	0.33	0.10	2.09	0.39
PL	94	106.14	56.26	2.13	1.40	3.25	4.79	0.08	0.18	.	.	.	.	0.42	0.11	2.57	0.48
PTTEP	136	46.36	30.87	1.74	0.53	1.86	0.39	0.07	0.12	39.65	19.89	0.59	0.03	0.29	0.10	0.29	0.15
PTT	612	81.49	44.63	1.21	0.29	1.18	0.29	0.04	0.09	14.78	1.32	0.13	0.02	0.31	0.03	0.59	0.08
QH	149	137.68	88.52	2.31	0.67	2.46	0.69	0.10	0.17	8.95	2.73	0.16	0.04	0.32	0.06	1.32	0.38
SCC	1,013	63.27	48.25	1.22	0.45	1.67	0.29	0.03	0.11	7.88	2.62	0.18	0.02	0.35	0.06	0.74	0.74
SCCC	101	83.22	24.72	1.82	0.16	2.23	0.18	0.08	0.09	7.60	2.52	0.25	0.05	0.28	0.01	0.27	0.03
DTAC	44	77.80	51.11	2.14	0.62	2.35	1.24	0.15	0.10	4.73	0.02	0.21	0.05	0.25	0.02	0.51	0.03
TCAP	73	95.48	55.17	1.67	0.44	1.69	0.35	- 0.06	0.11	.	.	.	.	0.88	0.02	9.26	3.58
TICON	37	85.35	32.66	1.66	0.42	2.05	0.14	- 0.04	0.12	7.23	2.71	0.50	0.06	0.40	0.06	0.50	0.14
THAI	438	85.26	63.82	1.79	0.50	1.93	0.56	- 0.13	0.18	3.22	1.40	0.07	0.06	0.42	0.05	3.02	1.06
TOP	75	64.17	36.71	1.65	0.36	1.80	0.64	- 0.11	0.18	14.42	2.00	0.10	0.01	0.24	0.01	0.50	0.20
TPC	30	207.40	84.04	3.75	0.63	3.72	0.48	0.32	0.24	4.16	3.29	0.12	0.09	0.28	0.03	2.10	0.83
TISCO	155	81.36	45.95	1.95	0.41	1.98	0.42	- 0.00	0.13	.	.	.	.	0.62	0.21	5.67	2.09
TUF	21	73.52	33.54	1.63	0.38	1.46	0.30	- 0.01	0.24	5.16	0.31	0.05	0.00	0.15	0.00	0.80	0.25

Table V

Correlation between each variable (Exclude Financial Ratio)

	SPREAD	*SI*	*SDG*	*SM*	*RI*	*RM*	*ABOVE*	*BELOW*	*GY*	*SY*	*TB*	*LNS*	*TTM*	*COUPON*	*MPI*	*FN*
SPREAD	1.0000															
SI	0.4326	1.0000														
SDG	0.2181	0.5038	1.0000													
SM	0.2727	0.1965	0.1211	1.0000												
RI	-0.0677	0.0755	0.0047	-0.0992	1.0000											
RM	-0.1578	-0.0874	-0.0837	-0.5616	0.1009	1.0000										
ABOVE	-0.0992	-0.1055	-0.1915	0.0168	-0.0468	0.0593	1.0000									
BELOW	0.3061	0.1882	0.1450	-0.0128	0.0507	0.0862	-0.1963	1.0000								
GY	-0.1960	-0.4254	-0.1772	-0.1896	-0.0259	-0.1581	0.1013	-0.1193	1.0000							
SY	0.2552	0.4140	0.1673	-0.0159	0.0131	0.3891	0.0092	0.1634	-0.6842	1.0000						
TB	-0.2270	-0.4245	-0.1504	0.0110	-0.0339	-0.2990	-0.0067	-0.1565	0.8348	-0.8787	1.0000					
LNS	-0.2074	-0.3458	-0.2434	0.0507	-0.0139	-0.0075	0.3482	-0.3546	0.0094	0.0038	0.0160	1.0000				
TTM	0.0653	-0.1315	-0.1773	-0.0002	0.0284	0.0724	0.4991	-0.0328	0.2901	-0.0246	0.0136	0.1608	1.0000			
COUPON	0.0641	0.0582	-0.0452	0.0323	0.2035	0.0950	0.0682	-0.0925	-0.1590	0.1806	-0.1007	0.1231	0.0534	1.0000		
MPI	0.0133	0.0014	-0.0070	-0.0462	0.0004	0.0754	0.0018	0.0037	-0.0120	0.0257	0.0146	0.0187	0.0215	0.0276	1.0000	
FN	0.0086	0.1668	0.1006	-0.0656	-0.0346	0.0114	-0.3510	0.1017	-0.0705	0.0364	-0.0846	-0.3571	-0.1999	-0.3923	-0.0212	1.0000

Table VI

Correlation between each variable (Include Financial Ratio for Non Financial Firms)

	SPREAD	*SI*	*SDG*	*SM*	*RI*	*RM*	*ABOVE*	*BELOW*	*ICR*	*OPM*	*LDA*	*DE*	*GY*	*SY*	*TB*	*LNS*	*TTM*	*COUPON*	*MPI*
SPREAD	1.0000																		
SI	0.4081	1.0000																	
SDG	0.2706	0.6139	1.0000																
SM	0.2439	0.1596	0.1417	1.0000															
RI	-0.0314	0.0577	-0.0863	-0.0817	1.0000														
RM	-0.1822	-0.1334	-0.1681	-0.5695	0.0350	1.0000													
ABOVE	-0.1224	-0.0658	-0.2918	-0.0371	-0.0609	0.1245	1.0000												
BELOW	0.2846	0.1496	0.1454	-0.0386	0.0851	0.0469	-0.2102	1.0000											
ICR	-0.0891	-0.0665	-0.0904	0.0356	0.0308	-0.0540	0.1949	-0.0998	1.0000										
OPM	-0.1128	0.1349	0.0918	-0.0186	0.1761	0.1515	0.1183	-0.1330	0.4587	1.0000									
LDA	0.0627	-0.0033	0.0406	-0.0071	0.0186	0.0779	-0.0569	0.0094	-0.3036	0.0329	1.0000								
DE	0.2730	0.2791	0.2078	0.1020	-0.1758	-0.1694	-0.1333	0.1615	-0.3992	-0.4890	0.3750	1.0000							
GY	-0.1519	-0.3755	-0.2101	-0.1881	-0.0610	-0.1488	0.0812	-0.0693	0.0890	-0.1886	-0.1500	-0.0168	1.0000						
SY	0.1893	0.3858	0.2074	-0.0466	0.0481	0.3957	0.0568	0.0612	-0.0643	0.2667	0.1648	-0.0497	-0.6658	1.0000					
TB	-0.1608	-0.3905	-0.1676	0.0249	-0.0858	-0.2999	-0.0784	-0.0562	0.0469	-0.2378	-0.1556	0.0224	0.8209	-0.8713	1.0000				
LNS	-0.2730	-0.4479	-0.3697	0.0119	-0.0110	0.0274	0.2504	-0.3999	-0.0771	-0.0535	0.2309	-0.1509	0.0238	-0.0092	0.0264	1.0000			
TTM	0.0242	-0.1647	-0.3163	-0.0082	0.0320	0.0535	0.5050	-0.1034	0.1152	-0.0115	0.0372	-0.1098	0.3788	-0.0994	0.0861	0.1196	1.0000		
COUPON	0.1181	0.2075	-0.0172	-0.0144	0.2445	0.1869	-0.1103	-0.0525	-0.2029	0.1180	0.1412	-0.0015	-0.3387	0.3716	-0.3181	0.0865	0.0001	1.0000	
MPI	0.0158	-0.0025	-0.0075	-0.0550	-0.0116	0.0747	-0.0083	-0.0078	-0.0148	0.0290	0.0337	-0.0168	-0.0124	0.0209	0.0143	0.0191	0.0136	0.0289	1.0000

Table VII

Correlation between each variable (Include Financial Ratio for Financial Firms)

	SPREAD	*SI*	*SDG*	*SM*	*RI*	*RM*	*ABOVE*	*BELOW*	*LDA*	*DE*	*GY*	*SY*	*TB*	*LNS*	*TTM*	*COUPON*	*MPI*
SPREAD	1.0000																
SI	0.5297	1.0000															
SDG	0.2113	0.4504	1.0000														
SM	0.3760	0.3548	0.1440	1.0000													
RI	-0.1806	0.1460	0.1195	-0.1614	1.0000												
RM	-0.0788	0.0241	-0.0038	-0.5396	0.2907	1.0000											
ABOVE	0.0135	0.0177	-0.0267	0.1901	-0.0929	-0.2732	1.0000										
BELOW	0.3788	0.2255	0.1382	0.0651	-0.0061	0.1713	-0.0895	1.0000									
LDA	0.1406	0.1765	-0.0209	-0.2246	0.0675	0.2707	-0.4578	0.1051	1.0000								
DE	-0.1834	-0.1387	-0.0807	0.1396	0.1184	-0.1985	0.3191	-0.3252	-0.0613	1.0000							
GY	-0.3438	-0.5473	-0.1644	-0.2175	0.0665	-0.1852	0.1058	-0.2134	-0.2645	0.2479	1.0000						
SY	0.4740	0.4926	0.1502	0.0897	-0.0828	0.3686	-0.1827	0.3819	0.2952	-0.3579	-0.7394	1.0000					
TB	-0.4291	-0.4848	-0.1410	-0.0496	0.0907	-0.2977	0.1763	-0.3344	-0.3476	0.3446	0.8740	-0.9047	1.0000				
LNS	-0.0511	0.0397	-0.0976	0.0807	-0.0747	-0.0921	0.3517	-0.2356	-0.1268	0.1105	-0.1355	0.0964	-0.1241	1.0000			
TTM	0.3670	0.2072	0.0590	-0.0495	-0.0300	0.2263	0.0019	0.3653	0.0773	-0.0507	-0.2496	0.4694	-0.4911	-0.0028	1.0000		
COUPON	-0.1217	-0.1107	0.0085	0.0962	0.0713	-0.2025	0.1594	-0.0802	-0.3193	0.1584	0.3439	-0.4263	0.4756	-0.4251	-0.2509	1.0000	
MPI	0.0055	0.0260	-0.0028	-0.0242	0.0330	0.0788	0.0076	0.0365	0.0073	0.0297	-0.0169	0.0439	0.0088	-0.0093	0.0458	-0.0113	1.0000

Table VIII

Explaining Corporate Bond Yield Spreads Using OLS

Using panel data since 2 July 2001 until 30 December 2008, we regress corporate bond yield spread (basis point) against the variables listed below. Eleven month dummies are including in the regression, but leave out from this table.

	Regression No.					
	(4)	(5)	(6)	(7)	(8.1)	(8.2)
Equity volatility						
S.D. of daily excess return (%)			***23.00***	***23.89***	***21.14***	***21.54***
S.D. of daily SET return (%)			***17.82***	***16.83***	***19.96***	***21.74***
Mean daily excess return(%)			***-22.21***	***-30.05***	**-13.86**	***-31.63***
Mean daily SET return(%)			***-34.39***	***-34.88***	***-26.50***	***-32.78***
Credit ratings						
Above A		***-12.54***		***-13.80***	***-9.56***	***19.03***
Below A		***47.28***		***48.95***	***50.89***	***20.37***
Financial ratio						
Interest coverage (times)					***0.26***	
Operating profit margin (times)					***-55.49***	
Long term debt to assets (times)					**29.20**	***21.65***
Total debt to capitalization (times)					***3.84***	***-1.72***
Macro economic and other variables						
Closest government bond yield (%)	***-3.69***	***-3.60***	***2.88***	***2.92***	**2.77**	***7.52***
10 yr.-2yr. government bond yield (%)	***12.31***	***10.30***	***13.54***	***11.17***	***11.53***	***16.64***
Issue size (log)	***-15.14***	***-8.71***	***-10.16***	***-3.23***	***-6.21***	**-3.68**
Time to maturity (years)	***2.95***	***3.96***	***2.77***	***3.92***	***3.31***	***7.42***
Coupon rate(%)	-0.07	0.50	0.62	**1.35**	***2.34***	0.60
Growth of MPI (%)	***-1.01***	***-0.96***	-0.24	-0.19	0.02	*-0.56*
Financial sector or not	***-9.05***	***-10.03***	***-7.85***	***-9.02***	(dropped)	(dropped)
Constant	***240.36***	***187.43***	***94.44***	***36.75***	***50.01***	-0.07
Number of observations	6,241	6,241	6,241	6,241	4,705	1,536
F	89.92	107.85	129.33	151.84	96.14	80.79
R^2	0.2064	0.2575	0.3139	0.3696	0.3569	0.5722
Adjusted R^2	0.2041	0.2551	0.3115	0.3671	0.3532	0.5651
RMSE	48.479	46.901	45.091	43.23	44.52	33.709

**Italic denote significance at 95% confidence level.*

****Bold denotes significance at 99% confidence level.**

******Bold and Italic denotes significance at 99.9% confidence level.***

Table IX

Regression with Issuer Fixed Effects

Using panel data between 2 July 2001 and 30 December 2008, we regress corporate bond yield spreads (basis point) against the variables listed below.We include fixed effects for each bond issuer and either 11 month dummies or 89 monthly time dummies.Note that regressions in gray columns were in financial sector.

	Regression No.					
	(7)	(7)	(8.1)	(8.1)	(8.2)	(8.2)
Eleven month time dummies	**Yes**	No	**Yes**	No	**Yes**	No
Eighty nine month time dummies	No	**Yes**	No	**Yes**	No	**Yes**
Equity volatility						
S.D. of daily excess return (%)	***17.30***	***7.97***	***8.21***	3.76	***20.57***	***6.03***
S.D. of daily SET return (%)	***22.70***	**15.15**	***24.22***	**17.64**	***23.60***	9.00
Mean daily excess return(%)	***-25.30***	*-7.71*	**-16.94**	4.10	***-38.73***	10.46
Mean daily SET return(%)	***-33.25***	17.71	***-35.13***	22.77	**-20.69**	-3.14
Credit ratings						
Above A	-3.01	2.21	4.16	7.95	***41.89***	10.22
Below A	***36.05***	***33.88***	***27.86***	***28.55***	***15.21***	***15.52***
Financial ratio						
Interest coverage (times)			-0.05	-0.00		
Operating profit margin (times)			**-47.98**	***-108.55***		
Long term debt to assets (times)			***70.05***	***54.52***	***36.30***	**18.41**
Total debt to capitalization (times)			***10.90***	**5.43**	-1.05	0.60
Macro economic and other variables						
Closest government bond yield (%)	***3.21***	***-7.82***	***3.58***	***-8.15***	***8.76***	***-13.25***
10 yr.-2yr. government bond yield (%)	***13.75***	-2.67	***11.03***	-5.73	***16.78***	9.94
Issue size (log)	***4.89***	*2.58*	**5.06**	*3.41*	**7.07**	0.77
Time to maturity (years)	***4.26***	***5.95***	***3.51***	***5.36***	***8.39***	***14.58***
Coupon rate(%)	***2.46***	0.85	**1.81**	0.86	**3.97**	***4.29***
Growth of MPI (%)	-0.18	0.34	0.08	0.69	*-0.54*	-0.27
Constant	***-44.11***	***150.25***	**-51.49**	***140.64***	***-117.99***	***156.01***
Number of observations	6,241	6,241	4,705	4,705	1,536	1,536
Number of issuers	32	32	24	24	8	8
R^2 within	0.3047	0.4554	0.2700	0.3989	0.5670	0.8004
R^2 between	0.4481	0.2402	0.3162	0.2274	0.0000	0.4273
R^2 overall	0.314	0.3935	0.2199	0.3013	0.5198	0.7777
F	117.86	50.57	63.77	28.92	78.72	61.19

**Italic denote significance at 95% confidence level.*

****Bold denotes significance at 99% confidence level.**

******Bold and Italic denotes significance at 99.9% confidence level.***

Table X

Interaction Effect on Bear Market Dummy Variable

Using panel data between 2 July 2001 and 30 December 2008, we regress corporate bond yield spreads (basis point) against the variables listed below. Eleven month dummies are included in the regression, but leave from this table. Regressions in gray columns were in financial sector.

	Regression		
	(7)	(8.1)	(8.2)
Equity volatility			
S.D. of daily excess return (%)	***20.98***	***24.42***	***10.49***
S.D. of daily SET return (%)	*3.63*	**9.93**	-2.86
Mean daily excess return(%)	***-22.61***	**-20.00**	0.93
Mean daily SET return(%)	-10.48	-14.73	***32.47***
Equity volatility slope drifter			
S.D. of daily excess return (%)*BMDV	5.08	-4.65	-0.22
S.D. of daily SET return (%)*BMDV	***54.34***	***55.49***	*45.76*
Mean daily excess return(%)*BMDV	9.64	***39.30***	-31.84
Mean daily SET return(%)*BMDV	*58.09*	**78.93**	-28.10
Credit ratings			
Above A	***-12.06***	*-4.09*	11.30
Below A	***58.47***	***71.18***	***16.47***
Credit ratings slope drifter			
Above A*BMDV	-2.66	**-11.13**	-5.40
Below A*BMDV	***-33.44***	***-49.35***	17.52
Financial ratio			
Interest coverage (times)		***0.39***	
Operating profit margin (times)		***-82.86***	
Long term debt to assets (times)		***46.61***	**14.83**
Total debt to capitalization (times)		0.09	***-2.78***
Financial ratio slope drifter			
Interest coverage (times)*BMDV		*-0.50*	
Operating profit margin (times)*BMDV		***78.75***	
Long term debt to assets (times)*BMDV		-41.69	7.14
Total debt to capitalization (times)*BMDV		**6.32**	0.83
Macro economic and other variables			
Closest government bond yield (%)	***10.42***	***10.56***	***19.53***
10 yr.-2yr. government bond yield (%)	***17.76***	***16.50***	***36.31***
Issue size (log)	***-5.57***	***-7.47***	***-6.46***
Time to maturity (years)	***2.45***	***1.64***	***4.01***
Coupon rate(%)	**1.12**	***2.90***	***3.29***
Growth of MPI (%)	*-0.48*	-0.41	-0.45
Financial sector or not	***-13.51***	(dropped)	(dropped)
Macro economic slope drifter			
Closest government bond yield (%)*BMDV	***-50.33***	***-46.29***	***-81.21***
10 yr.-2yr. government bond yield (%)*BMDV	**-41.63**	*-36.12*	***-79.52***
Issue size (log)*BMDV	**5.55**	*6.07*	*6.60*
Time to maturity (years)*BMDV	***9.04***	***8.43***	***22.05***
Coupon rate(%)*BMDV	*2.90*	*3.47*	-0.23
Growth of MPI (%)*BMDV	***2.57***	***2.74***	1.46
Financial sector or not*BMDV	**10.46**	(dropped)	(dropped)
Bear market period or not	67.49	48.58	***252.80***
Constant	**27.56**	21.29	*-31.47*
Number of observations	6,241	4,705	1,536
F	106.52	67.41	83.63
R^2	0.4574	0.4437	0.7419
Adjusted R^2	0.4531	0.4371	0.7330
RMSE	40.186	41.533	26.413

**Italic denote significance at 95% confidence level.*

****Bold denotes significance at 99% confidence level.**

******Bold and Italic denotes significance at 99.9% confidence level.***

Table XI

Explaining Corporate Bond Yield Spreads Using OLS (Employ S.D. (GARCH(1,1))

Using panel data since 2 July 2001 until 30 December 2008, we regress corporate bond yield spread (basis point) against the variables listed below. Eleven month dummies are including in the regression, but leave out from this table. Note that regressions in gray columns were in financial sector.

	Regression			
	(6A)	(7A)	(8.1A)	(8.2A)
Equity volatility				
S.D. GARCH (1,1) (%)	***6.01***	***5.16***	***9.37***	***3.43***
S.D. of daily SET return (%)	***17.51***	***16.75***	***17.59***	***29.59***
Mean daily excess return(%)	***-14.40***	***-21.17***	-7.25	-10.41
Mean daily SET return(%)	***-52.03***	***-53.95***	***-42.68***	***-37.07***
Credit ratings				
Above A		***-10.68***	**-5.61**	***27.39***
Below A		***49.05***	***49.19***	***19.91***
Financial ratio				
Interest coverage (times)			**0.23**	
Operating profit margin (times)			***-44.48***	
Long term debt to assets (times)			14.19	***31.51***
Total debt to capitalization (times)			***7.30***	***-2.32***
Macro economic and other variables				
Closest government bond yield (%)	0.57	0.59	1.42	**3.98**
10 yr.-2yr. government bond yield (%)	***18.21***	***16.24***	***14.72***	***19.93***
Issue size (log)	***-14.29***	***-8.10***	***-10.55***	*-3.01*
Time to maturity (years)	***3.07***	***3.90***	***3.43***	**8.16**
Coupon rate(%)	*0.94*	***1.72***	***3.52***	1.94
Growth of MPI (%)	-0.24	-0.18	0.06	*-0.56*
Financial sector or not	***-6.35***	***-6.76***	(dropped)	(dropped)
Constant	***159.66***	***109.97***	***100.94***	21.21
Number of observations	6,241	6,241	4,705	1,536
F	110.27	128.4	88.82	70.91
R^2	0.2806	0.3314	0.3389	0.5400
Adjusted R^2	0.2781	0.3289	0.3351	0.5324
RMSE	46.171	44.519	45.137	34.955

**Italic denote significance at 95% confidence level.*

****Bold denotes significance at 99% confidence level.**

******Bold and Italic denotes significance at 99.9% confidence level.***

Table XII

Regression with Issuer Fixed Effects (Employ S.D. (GARCH(1,1))

Using panel data between 2 July 2001 and 30 December 2008, we regress corporate bond yield spreads (basis point) against the variables listed below.We include fixed effects for each bond issuer and either 11 month dummies or 89 monthly time dummies.Note that regressions in gray columns were in financial sector.

	Regression					
	(7A)	(7A)	(8.1A)	(8.1A)	(8.2A)	(8.2A)
Eleven month time dummies	**Yes**	No	**Yes**	No	**Yes**	No
Eighty nine month time dummies	No	**Yes**	No	**Yes**	No	**Yes**
Equity volatility						
S.D. GARCH (1,1) (%)	***3.55***	**1.88**	3.25	1.70	**2.42**	0.90
S.D. of daily SET return (%)	***24.44***	**16.07**	***23.94***	**18.06**	***30.78***	10.13
Mean daily excess return(%)	***-15.52***	-3.34	*-12.93*	6.23	**-22.37**	**15.31**
Mean daily SET return(%)	***-43.75***	15.67	***-40.53***	22.53	**-21.65**	-7.25
Credit ratings						
Above A	*-6.96*	1.10	3.20	7.62	***50.96***	*11.75*
Below A	***35.07***	***33.07***	***22.17***	***26.06***	***16.03***	***15.57***
Financial ratio						
Interest coverage (times)			-0.08	-0.01		
Operating profit margin (times)			**-46.45**	***-107.51***		
Long term debt to assets (times)			***66.30***	**49.11**	*37.66*	*17.12*
Total debt to capitalization (times)			***11.83***	***5.78***	-0.07	0.81
Macro economic and other variables						
Closest government bond yield (%)	*1.70*	***-7.55***	**3.12**	***-8.04***	***6.16***	***-12.65***
10 yr.-2yr. government bond yield (%)	***17.02***	-2.73	***12.24***	-5.79	***21.60***	10.65
Issue size (log)	***5.48***	*2.66*	**4.91**	*3.25*	**9.01**	1.11
Time to maturity (years)	***4.78***	***5.97***	***3.62***	***5.35***	***9.86***	***14.44***
Coupon rate(%)	***3.33***	**1.13**	***2.32***	1.03	***5.15***	***4.52***
Growth of MPI (%)	-0.17	0.31	0.09	0.68	*-0.59*	-0.33
Constant	*-29.65*	***160.78***	**-43.81**	***145.93***	***-114.99***	***160.36***
Number of observations	6,241	6,241	4,705	4,705	1,536	1,536
Number of issuers	32	32	24	24	8	8
R^2 within	0.2902	0.4532	0.2681	0.3986	0.5378	0.7988
R^2 between	0.1864	0.1499	0.2204	0.1996	0.1600	0.2077
R^2 overall	0.2539	0.3683	0.1946	0.2926	0.4573	0.77
F	109.95	50.13	63.13	28.89	69.95	60.57

Figure 1

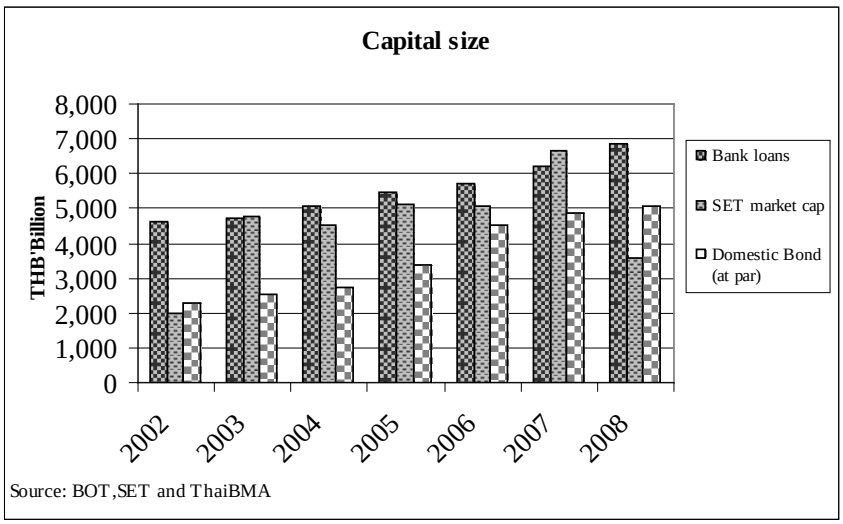
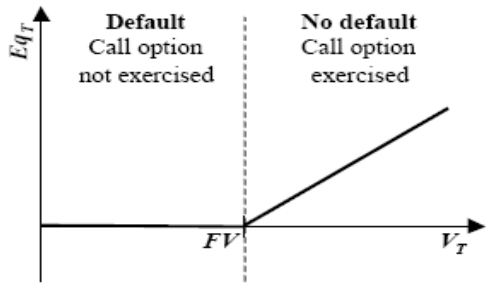
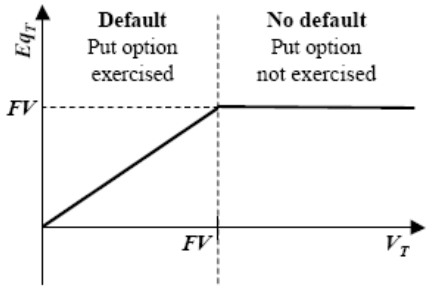


Figure 1: Market capital value of bank loans, stock market and bond market.

Figure 2



Shareholder's payoff:
Long call option on firm value



Bondholder's payoff:
Long risk free bond and short put option on firm value

Figure 2: Payoff of equity holder and bondholder.

Figure 3

Figure 3: SET index during period of study (2 July 2001- 30 December 2008).

APPENDIX

Parameter value in market model and GARCH (1,1)						
Stock Symbol	Market model		p-value	GARCH (1,1) model		
	α	β	LM test	ω	δ	ν
AEONTS	4.22E-04	*0.58*	0.00	*3.73E-05*	*0.12*	*0.83*
AIS	3.73E-04	*0.98*	0.00	*1.48E-06*	*0.02*	*0.98*
BAY	-2.78E-05	*1.34*	0.00	*2.03E-05*	*0.11*	*0.83*
BECL	5.56E-04	*0.67*	0.00	*3.43E-06*	*0.07*	*0.92*
BGH	*2.18E-03*	*0.45*	0.74	-6.31E-07	*0.26*	*0.88*
CENT	*2.23E-03*	*0.49*	0.98	*2.28E-03*	*0.00*	*-0.90*
CK	2.78E-04	*1.37*	0.00	*1.71E-05*	*0.10*	*0.89*
CPF	3.06E-04	*0.59*	0.98	*1.48E-04*	*0.08*	*0.45*
CPN	*1.75E-03*	*0.87*	0.42	*4.30E-06*	*0.14*	*0.90*
EASTW	9.68E-04	*0.36*	0.93	*4.01E-06*	*0.00*	*1.00*
HMPRO	*3.24E-04*	*0.66*	0.00	*1.71E-05*	*0.11*	*0.86*
ITD	5.36E-05	*1.69*	0.00	*4.38E-06*	*0.04*	*0.96*
KK	-2.17E-04	*1.18*	0.00	*2.82E-05*	*0.14*	*0.80*
KTB	-6.92E-04	*1.27*	0.00	*3.50E-05*	*0.09*	*0.77*
KTC	-3.20E-04	*0.72*	0.00	*2.64E-06*	*0.03*	*0.96*
LH	4.11E-04	*1.31*	0.00	*4.12E-06*	*0.02*	*0.97*
MBK	*6.60E-04*	*0.35*	0.00	*5.31E-05*	*0.26*	*0.45*
NMG	-8.79E-04	*0.55*	0.00	*2.87E-05*	*0.15*	*0.81*
PL	*1.29E-03*	*0.60*	0.95	*7.15E-06*	*1.28*	*0.63*
PTTEP	*1.07E-03*	*1.02*	0.07	*4.14E-05*	*0.09*	*0.80*
PTT	*7.99E-04*	*1.17*	0.00	*4.37E-06*	*0.09*	*0.89*
QH	2.60E-04	*1.39*	0.11	*2.99E-05*	*0.12*	*0.83*
SCC	*7.27E-04*	*0.86*	0.08	2.85E-08	*0.02*	*0.98*
SCCC	4.54E-05	*0.78*	0.00	*3.78E-05*	*0.11*	*0.76*
DTAC	7.72E-04	*1.03*	0.00	*4.64E-05*	*0.24*	*0.66*
TCAP	-2.37E-05	*1.29*	0.00	*3.79E-05*	*0.12*	*0.78*
TICON	5.89E-04	*0.75*	0.00	*3.32E-04*	*0.29*	*0.12*
THAI	-7.76E-04	*0.93*	0.00	*2.28E-06*	*0.03*	*0.97*
TOP	-1.54E-04	*1.23*	0.00	*5.53E-05*	*0.17*	*0.62*
TPC	*1.52E-03*	*0.63*	0.01	6.63E-08	*0.01*	*0.99*
TISCO	-4.49E-04	*1.30*	0.00	*2.30E-05*	*0.09*	*0.85*
TUF	6.03E-04	*0.34*	0.85	*7.93E-06*	*0.09*	*0.89*

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Jun-Dec 2006	Credit Management Trainee (Commercial Banking Centre-Phahurad) United Overseas Bank (Thai) Public Company Limited
Apr – May 2005	Student Internship (Research Department) KGI Securities (Thailand) Public Company Limited
Apr 2004	Student Internship (Saphan-Khao branch) Bangkok Bank Public Company Limited

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2005 - 2006	President of Financial and Banking (FIBA) Club
2004 - 2005	Committee in Acounting Club & Financial and Banking Club Teaching Assistant of Associated Professor Kanya Tantawudtoe
2003 - 2004	Leader in Accy Chor-Chang Group

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2006	His Majesty the King Bhumibol Scholarship (Gold Medal) Thammasat Renowned Undergraduate Student in Academic Activity Good Manners Students from Buddhist association
2005	AJF Young Fund Manager Winners (Fixed Income Portfolio)
2004	UFJ Foundation Scholarship

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2006	Compare CIR and Vasicek model for explaining short rate movement behavior in Thailand, *Thammasat Business Journal* 29, p.33-44 (Thai)

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