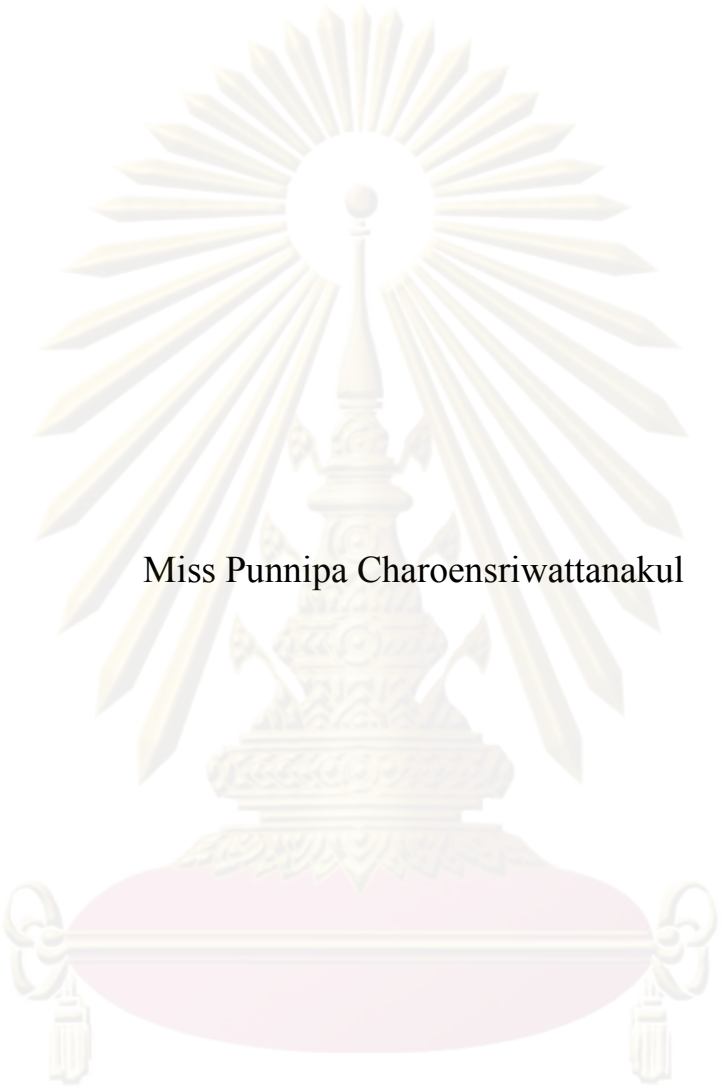
LIQUIDITY AND DEFAULT RISKS IN CORPORATE BONDS

Miss Punnipa Charoensriwattanakul



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ความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้ในหุ้นกู้เอกชน

นางสาว พรรณนิภา เจริญศรีวัฒนกุล

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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พรรณนิภา เจริญศรีวัฒนกุล : ความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้ในหุ้นกู้เอกชน. (LIQUIDITY AND DEFAULT RISKS IN CORPORATE BONDS) อ.ที่ปรึกษาวิทยานิพนธ์หลัก : รศ. ดร. สันติ ถิรพัฒน์, 37 หน้า.

การศึกษานี้แสดงให้เห็นว่าความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้เป็นปัจจัยหลักที่ส่งผลต่อส่วนต่างของอัตราผลตอบแทนในหุ้นกู้เอกชนในตลาดนานาชาติ จากการใช้สองวิธีการวัดสภาพคล่อง (จำนวนร้อยละของผลตอบแทนที่มีค่าเป็นศูนย์ และ แบบจำลองที่ตัวแปรตามที่มีค่าจำกัดของ Lesmond, Ogden, และ Trzcinka (1999) หรือ ค่าประมาณแบบ LOT) และ สองวิธีการวัดความเสี่ยงในการผิดนัดชำระหนี้ (ความน่าจะเป็นของการผิดนัดชำระหนี้ และ การประเมินความเสี่ยงด้านเครดิต) ในชุดข้อมูลกว่า 8,000 ตัวอย่าง ใน 5 ประเทศ ซึ่งประกับด้วยประเทศแคนนาดา, ประเทศฝรั่งเศส, ประเทศญี่ปุ่น, สหราชอาณาจักร และ ประเทศสหรัฐอเมริกา การศึกษานี้พบว่าทั้งความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้มีนัยสำคัญและมีความสัมพันธ์เป็นบวกกับส่วนต่างของอัตราผลตอบแทนในหุ้นกู้เอกชน อย่างไรก็ตามเมื่อขยายการศึกษาไปยังการเปลี่ยนแปลงของส่วนต่างอัตราผลตอบแทนการศึกษานี้พบว่ามีเพียงการเปลี่ยนแปลงของความเสี่ยงทางด้านสภาพคล่องเท่านั้นที่มีนัยสำคัญและมีความสัมพันธ์เป็นบวกกับการเปลี่ยนแปลงของส่วนต่างอัตราผลตอบแทนในหุ้นกู้เอกชน หรืออีกนัยหนึ่ง คือ มีเพียงการเปลี่ยนแปลงของความเสี่ยงทางด้านสภาพคล่องเท่านั้นที่เป็นปัจจัยหลักที่ส่งผลต่อการเปลี่ยนแปลงของส่วนต่างอัตราผลตอบแทนในหุ้นกู้เอกชนในตลาดนานาชาติ นอกจากนั้นการศึกษานี้ยังสร้างกลุ่มหลักทรัพย์ของหุ้นกู้เอกชนโดยใช้เกณฑ์ของความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้ การศึกษานี้พบว่าค่าแอลฟ่ามีนัยสำคัญและมีความสัมพันธ์เป็นบวกกับส่วนต่างของอัตราผลตอบแทนในหุ้นกู้เอกชน และค่าแอลฟ่ามีแนวโน้มเพิ่งขึ้นตามความเสี่ยงทางด้านสภาพคล่องที่เพิ่มขึ้นและความเสี่ยงในการผิดนัดชำระหนี้ที่เพิ่มขึ้น ซึ่งสามารถสรุปได้ว่าทั้งความเสี่ยงทางด้านสภาพคล่องและความเสี่ยงในการผิดนัดชำระหนี้มีความสอดคล้องกันกับส่วนต่างของอัตราผลตอบแทนในตลาดนานาชาติ

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PUNNIPA CHAROENSRIWATTANAKUL : LIQUIDITY AND DEFAULT RISKS IN CORPORATE BONDS. THESIS ADVISOR : ASSOC. PROF. SUNTI TIRAPAT, Ph.D., 37 pp.

This study reveals that both liquidity and default risks are the main factors affecting the yield spreads of corporate bonds in an international market. Using two measures of liquidity (the percentage of zero returns and the limited dependent variable estimate of Lesmond, Ogden, and Trzcinka (1999) or LOT measure) and two measures of default (probability of default and credit scoring) on a dataset of over 8,000 bond-years in five countries consisting of Canada, France, Japan, United Kingdom, and United States, this study finds that both liquidity and default risks are significantly and positively associated with yield spreads. However, when extending the study to change in yield spreads, it is found that only an increase in liquidity risk is significantly and positively associated with an increase in yield spreads, implying that only change in liquidity risk is the main factor that drives corporate bonds yield spread change in an international market. Moreover, this study constructs bond portfolios by using liquidity and default measures criteria. This study finds that the alphas are significantly and positively associated with yield spreads and strongly increase as the portfolios proceed from less to more liquidity risk and less to more default risk. It can be concluded that both liquidity and default risks are consistent with yield spreads in an international market.

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CHAPTER I
INTRODUCTION

1.1 Background and Problem Review

Corporate bonds are usually traded at lower price relative to government bonds because they contain more risk factors. The additional risk factors affecting corporate bonds price are liquidity and default risks. Several studies investigate whether liquidity or default risk is the main factor in explaining corporate bonds yield spread. Longstaff, Mithal, and Neis (2005) and Covitz and Downing (2007) find that default risk is the key factor for explaining yield spreads in the US bond market. On the other hand, Chen, Lesmond, and Wei (2007), Hund and Lesmond (2008), and Landschoot (2008) find that liquidity risk is a key determinant in yield spreads in the US, emerging, and euro bond markets respectively. It casts doubt upon whether liquidity or default risk is the main factor in explaining yield spreads. This study investigates whether liquidity or default risk is the main factor that drives corporate bonds yield spread.

To measure the size of the default component in yield spreads, many studies (Covitz and Downing (2007), Chen, Lesmond, and Wei (2007), and Hund and Lesmond (2008)) use credit rating. Since rating agencies focus on measuring default risk over long investment horizons, this causes ratings are changed only when changes in a company's risk profile are likely to be permanent. Altman and Rijken (2004) claim that the rating agencies do not focus on short investment horizons, resulting in credit rating which does not reflect the changes in economic landscape. Altman and Rijken (2006) also find the performance of default prediction using credit scoring is better than rating agencies do for short prediction time horizons. Moreover, Bandyopadhyay (2007) finds that the probability of default is forward looking and reflecting the current position in the credit cycle. In accordance with these findings, it can be concluded that the probability of default and credit scoring are more appropriate approach relative to credit rating to reflect default risk. This study uses probability of default and credit scoring instead of credit rating in measuring the size of the default component in yield spreads.

Most previous studies investigate source of the corporate bond spread (liquidity or default risk) by using corporate bonds data from the US bond market that

might not be good representative for bond markets around the world. To present a more complete picture, this study extends to investigate corporate bonds data in an international market consisting of Canada, France, Japan, United Kingdom, and United States which have amount of corporate bonds outstanding around 70 percent of total[1] as a representative of global bond market. This study expects that the more sample data are able to explain liquidity and default effect on yield spreads precisely.

Recently, Chacko (2005) investigates whether liquidity risk is consistent with yield spreads by measuring each bond issue's liquidity from its weighted average turnover value in US corporate bond markets. Moreover, Zhang (2007) investigates whether default risk is consistent with yield spreads by measuring each bond issue's default from its probability of default in US corporate bond markets. Both Chacko (2005) and Zhang (2007) sort the bond into five categories by their liquidity and default risks respectively. Then, they observe alpha of each liquidity and default portfolios by running regressions of each portfolio against common measures of systematic risk factors. Their studies use alpha as an indicator in pricing liquidity and default risks. They find that the alphas increase as the portfolios proceed from less to more illiquid and less to more default. They conclude that the pattern of the alphas is strongly important in pricing liquidity and default risks. This study also investigates whether liquidity and default risks are consistent with yield spreads in an international market.

This study uses different liquidity measure from Chacko (2005) by employing the limited dependent variable estimate of Lesmond, Ogden, and Trzcinka (1999) or LOT measure as the liquidity measure instead of turnover because the LOT measure is more sophisticated approach. Moreover, the LOT measure is a comprehensive estimate of liquidity by including the spread and other costs that may impinge on informed trade, such as commission costs, opportunity costs, and price impact costs.

1.2 Contribution

This study uses more extensive data than that of previous papers. This study uses sample data in an international market (Canada, France, Japan, United Kingdom, and United States); as a result, this study can be used as representative of bond

[1] Source: Global Financial Stability Report (September 2005)

markets around the world. Moreover, this study uses probability of default and credit scoring instead of credit rating in measuring the size of the default component in yield spreads. Both probability of default and credit scoring are more appropriated approaches since they reflect default risk and provide better performance of default prediction in short investment horizons than credit rating. Additionally, this study controls liquidity risk in order to examine whether liquidity risk is consistent with yield spreads better than Chacko (2005); thus, the result from this study can present more accuracy than Chacko (2005).

1.3 Objective of the Study

1. To investigate whether liquidity or default risk is the main factor that drives corporate bonds yield spread in an international market.
2. To examine whether liquidity and default risks are consistent with yield spreads in an international market.

1.4 Statement of Problem/ Research Questions

1. Whether liquidity or default risk is a key determinant in yield spreads in an international market?
2. Whether liquidity and default risks are consistent factors with yield spreads in an international market?

1.5 Scope of the Study

This study uses corporate bonds data from Canada, France, Japan, United Kingdom, and United States. The corporate bonds that are used in this study are straight bond. The period of this study is during 1997 – 2007. In addition, the study does not concern currency risk.

CHAPTER II
LITERATURE REVIEW

This section summarizes related literatures that investigate whether liquidity or default risk is the main factor that drives corporate bonds yield spread. This section is divided into 2 parts as follows.

2.1 Yield Spread Determinants

Longstaff, Mithal, and Neis (2005), and Covitz and Downing (2007) find that default risk is the key factor for explaining yield spreads in the US bond market. Longstaff, Mithal, and Neis (2005) measure the size of the default component in yield spreads by using the credit default swap premium directly as a measure of the default component in corporate spreads, and using a reduced-form model approach to measure the size of the default component. For non-default component, they use the size of the bid–ask spread and the principal amount outstanding. They find that the default component accounts for the majority of the corporate spread across all credit ratings. However, they focus only on 68 issuers that have liquid default-swap trading data, leaving some doubt as to the generality of the results for the larger universe of corporate bonds. Covitz and Downing (2007) use sample data around 4,000 corporate bonds. They use the log of the 1-year expected default frequency, the log of the firm's average long-term credit rating, and the log of the issuer's equity return volatility over the previous 60 business days as default risk variables. For liquidity risk variables, they use the log of the number of trades, the log of the total face value issued, and the log of the days to maturity of the commercial paper. They find that liquidity plays a role in the determination of spreads but credit quality is the most important determinant of spreads.

Many empirical studies (Chen, Lesmond, and Wei (2007), Hund and Lesmond (2008), and Landschoot (2008)) show that liquidity risk is a key determinant in yield spreads in the US, emerging, and euro bond markets respectively. Both Chen, Lesmond, and Wei (2007) and Hund and Lesmond (2008) use credit rating as default variable and use bid-ask spread, the percentage of zero returns, and the limited dependent variable estimate of Lesmond, Ogden, and Trzcinka (1999) or LOT measure. Both of them find that liquidity is a key determinant in yield spreads,

explaining as much as half of the cross-sectional variation in yield spread levels and as much as twice of the cross-sectional variation in yield spread changes than is explained by the influence from the credit rating alone. Landschoot (2008) measures the size of the default component in yield spreads by using change in 3 months Euribor, change in 3 months US Treasury bill rate, change in difference between 10 yr euro government bond yield and 3 months Euribor, change in difference between 10 yr US government bond yield and 3 months US Treasury bill rate, change in empirical volatility of 3 month Euribor, and change in empirical volatility of 3 months US Treasury bill rate. He measures the size of the liquidity component in yield spreads by using only bid-ask spread. He finds that change in liquidity risk contributes a significant fraction of euro corporate yield spread changes.

2.2 Liquidity and Default Risks

Recently, Chacko (2005) investigates whether liquidity risk is consistent with yield spreads by measuring each bond issue's liquidity from its weighted average turnover value in US corporate bond markets. He sorts the bond into five categories by their liquidity. After that, he uses CAPM model in finding alpha for each category in order to using alpha as an indicator in pricing liquidity. He finds that the alphas increase as the portfolios proceed from more to less liquid. He concludes that the pattern of the alphas strongly suggests that liquidity is not only important factor in explaining returns, but also shows the consistency with yield spreads.

Zhang (2007) investigates whether default risk is consistent with yield spreads by measuring each bond issue's default from its probability of default in US corporate bond markets. He sorts bond sample into quintiles according to their distress measures. Then, he uses Fama and French (1993) model in finding alpha for each quintile in order to use alpha as an indicator in pricing default risk. He finds that the relationship between probability of default and yield spreads are significant and positive for both equal- and value- weighted portfolios. The pattern of the alphas indicates that default risk is consistent with yield spreads.

In summary, previous literatures collect the corporate bonds data from the US bond markets that seemingly might not be a good representative for the corporate bond markets around the world. This study extends to investigate corporate bonds data in an international market (Canada, France, Japan, United Kingdom, and United

States) expected to be better representative sample of the global bond market. From reviewing many literatures, all of them focus on only single bond market except Hund and Lesmond (2008) that uses the sample data from various bond markets. In the aspect of yield spreads, our determinants are chosen following Hund and Lesmond (2008) except the default variable. To measure the size of the default component in yield spreads, this study uses the probability of default and credit scoring instead of credit rating because both of them can reflect the default risk and provide performance of default prediction in short investment horizons better than credit rating. Furthermore, this study uses different liquidity measure from Chacko (2005) by employing the LOT measure as the liquidity measure instead of turnover because the LOT measure is more sophisticated approach. Moreover, the LOT measure is a comprehensive estimate of liquidity by including the spread and other costs that may impinge on informed trade, such as commission costs, opportunity costs, and price impact costs.

Research Hypotheses

There are two main hypotheses in this study:

Hypothesis 1: Liquidity and default risks are positively associated with yield spreads.

Various theoretical models such as Amihud and Mendelson (1986) predict that investors demand higher expected returns for more illiquid or more default risk assets to compensate for the liquidity or default risk. This implies that, for the same cash flows in the future, more illiquid or more default risk assets will have lower prices. Since bond yield is a promised yield given known cash flows, the lower prices of more illiquid or more default risk bonds lead to higher bond yields and higher yield spreads, ceteris paribus.

Hypothesis 2: High illiquid bonds and high default bonds outperform low illiquid bonds and low default bonds.

The principle of risk-return tradeoff is that potential return rises with an increase in risk. Low levels of uncertainty (low risk) are associated with low potential returns, whereas high levels of uncertainty (high risk) are associated with high potential returns. According to the risk-return tradeoff, bonds which have high liquidity or default risk should generate higher returns than less one.

CHAPTER III
DATA AND METHODOLOGY

3.1 Data and Sample

The sample in this study includes corporate bonds in Canada, France, Japan, United Kingdom, and United States, which are listed in DataStream during 1997-2007. The bonds which price, modified duration, yield spreads, Standard & Poor's rating, and accounting data of firm that issue bond do not available in the DataStream are eliminated. Total sample data in this study are 8,145 bond-year observations. There are 666, 65, 342, 71, and 7,001 bond-year observations in Canada, France, Japan, United Kingdom, and United States respectively.

Corporate bond data

The corporate bond data are clean prices, modified duration, yield spreads, ten-year Treasury note rate, and the S&P 500 index. The DataStream provides all of these data except ten-year Treasury note rate. The clean price and modified duration are collected in daily for each corporate bond. The yield spreads are obtained from the DataStream as the computed yield on the bond less the U.S. Treasury bond closest matched to the bond's (risk-free) maturity in daily and annually. The S&P 500 index is also collected in daily. The ten-year Treasury note rate is obtained from the Federal Reserve Bank in daily.

Control variables

The control variables in this study are accounting variables, market-based variables, bond specific variables, corruption perception index (CPI), the legal origin of the country, U.S. macroeconomic variables, and each country macroeconomic and economic development variables. The accounting variables are net income, total assets, total liabilities, short-term debt, and long-term debt. These variables are obtained from the DataStream in annually. For market-based variables, stock price, market index, market capitalization of each firm, and total market capitalization of each market are collected in annually (except stock price is collected in daily) from DataStream.

For each corporate bond, bond specific variables are collected from the DataStream. The examples of bond specific variables are coupon rate, issue date, amount of outstanding, age, maturity and credit rating. Credit rating of each corporate bond is obtained from the history of changes in the Standard & Poor's rating. The issue rating classified by Standard & Poor's rating and year as well as the total by year?? is reported in Table 1.

Table 1: The issue rating

This table is based on a panel of bonds covering the eleven years from 1997 through 2007. DataStream is the sources for the data on this panel of bonds. The issue rating classified by Standard & Poor's rating and year as well as the total by year is given.

Rating	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
AAA	0	0	0	1	5	14	14	17	17	17	17	102
AA+	7	8	0	1	3	0	0	0	0	0	0	19
AA	1	1	10	11	12	12	12	13	19	16	19	126
AA-	1	2	2	7	12	36	24	39	38	45	36	242
A+	0	5	9	12	39	82	88	99	111	106	96	647
A	11	8	4	4	20	65	94	124	123	159	166	778
A-	1	1	1	1	6	80	93	122	138	131	125	699
BBB+	0	0	0	0	18	70	86	107	129	163	158	731
BBB	0	0	2	3	15	77	138	154	188	212	247	1,036
BBB-	0	0	0	0	11	74	112	115	121	138	115	686
BB+	0	0	0	0	3	38	37	71	97	76	57	379
BB	0	0	0	0	0	8	13	28	39	84	81	253
BB-	0	0	0	0	0	8	19	45	66	60	77	275
B+	0	0	0	0	1	11	22	70	95	98	77	374
B	0	0	0	0	1	10	29	43	66	89	92	330
B-	0	0	0	0	0	6	12	37	56	87	68	266
CCC+	0	0	0	0	0	0	3	8	21	14	19	65
CCC	0	0	0	0	0	3	3	12	14	20	23	75
CCC-	0	0	0	0	0	0	0	4	4	6	10	24
CC	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	2	2
D	0	0	0	0	0	0	0	0	0	0	0	0
NR	37	50	58	61	85	137	145	109	111	123	120	1,036
Total	58	75	86	101	231	731	944	1,217	1,453	1,644	1,605	8,145

Moreover, the corruption perception index (CPI) of each country is obtained from Transparency International. Additionally, the legal origin of the country can be taken from LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (1999).

For the U.S. macroeconomic variables, portfolio of long-term U.S. government bonds, portfolio of short-term U.S. government bonds, portfolio of BAA-rated bonds, and portfolio of AAA-rated bonds are collected in daily from the Federal Reserve Bank. The three-month Treasury bill rate, the one-year Treasury note rate, the two-year Treasury note rate, the ten-year Treasury note rate, and one-month Euro-Dollar deposit rate are derived from the Federal Reserve Bank in annually.

Each country macroeconomic and economic development variables are consist of external trade balance, total reserves, gold, total debt, total export, total import, inflation and GDP. All of them except inflation and GDP are collected from IMF Financial Statistic (IFS) in the DataStream. The inflation and GDP of each country can collect from the World Development Indicators database provided by the World Bank. The variables are summarized in appendix B.

3.2 Methodology

This section is divided into four parts. Firstly, the methodology for measuring liquidity risk is presented. Second, this part shows the detail in default measures. Third, liquidity and default effect on yield spreads are discussed. Finally, this part presents methodology for investigating whether liquidity and default risks are a consistent factor with yield spreads.

3.2.1 Liquidity measures

This study uses two approaches in measuring liquidity, which are the percentage of zero returns and the limited dependent variable estimate of Lesmond, Ogden, and Trzcinka (1999) or LOT measure because both of them are properly estimate liquidity cost. The percentage of zero returns has been found to be an effective liquidity measure in all market (Lesmond, Schill, and Zhou (2004), Bekaert, Campbell, and Lundblad (2003), etc.). Moreover, Chen, Lesmond, and Wei (2007) claim that the percentage of zero returns is properly estimate liquidity costs. This study uses the LOT measure for the reason that the LOT measure is a comprehensive estimate of liquidity by including the spread and other costs that may impinge on

informed trade, such as commission costs, opportunity costs, and price impact costs. Additionally, Chen, Lesmond, and Wei (2007) claim that the bid-ask spread is arguably the most utilized measure of liquidity costs. However, the bid–ask spread is not always available for all bonds or for all periods. They test the association between the modified Lesmond model and the bid-ask spread. They find that the modified Lesmond model are highly associated with the underlying bid–ask spread, hence the LOT measure can use in predicting liquidity cost instead of the bid-ask spread. Since the LOT measure is quite sophisticated measurement and less noisy measurement, this study uses the LOT measure as the main liquidity measure.

The percentage of zero returns

The percentage of zero returns (%Zeros measure) is a noisy measure that is incapable of distinguishing lack of trading due to low information or high liquidity costs (Lesmond, Ogden, and Trzcinka (1999)). The daily clean prices which are already delete prices that deviate more than 50% from the prior day's price is applied. Then, the frequency of days where zero price changes occur is counted. After that, the percentage of zero returns is calculated from percentage of daily returns that are equal to zero divided by the available days per year as

$$\%Zero_i = \frac{f_i}{n_i} \quad (1)$$

Where f_i is frequency of days where zero price changes occur for bond-year i.

n_i is the number of available days of bond-year i.

The LOT measure

The LOT measure is a joint estimation of both the liquidity threshold and the return-generating process (Lesmond, Ogden, and Trzcinka (1999)). The LOT estimation covers all relevant costs of liquidity, and includes both search costs and commission costs. Lesmond, Ogden, and Trzcinka (1999) suggest in using daily clean prices, which has already deleted prices that deviate more than 50% from the prior day's price. This study will estimate separately in each year due to the study estimates bond liquidity for each bond year. This approach assumes that returns are generated by a two-factor model, with the factors being the yield on the risk-free bond (which Lesmond, Ogden, and Trzcinka (1999) proxy by the ten-year Treasury note rate) and

the return on equity markets (which Lesmond, Ogden, and Trzcinka (1999) use the S&P 500 daily return as proxy).

Amihud and Mendelson (1986, 1987) argue that the existence of a liquidity premium implies that more illiquid assets to be priced at a discount to fundamental values to compensate investors for liquidity costs. Thus, there will be a gap between the observed and fundamental values of the asset, which Lesmond, Ogden, and Trzcinka (1999) break into two components, α_{1i}, the sell side cost of bond i and α_{2i}, the buy side cost of bond i. Observed returns will differ from fundamental values of the asset and will be related via the implied "liquidity cost" estimates, α_1 and α_2.

To figure out the value of α_{1i} and α_{2i}, Lesmond, Ogden, and Trzcinka (1999) use the likelihood function of the limited dependent variable as given $R_{i,t}$, duration, S&P Index. The resulting log-likelihood function is stated as:

$$
\begin{aligned}
LnL_i \;=\; & \sum_1 Ln \frac{1}{(2\pi\sigma_i^2)^{1/2}} \\
& - \sum_1 \frac{1}{2\sigma_i^2}\left(R_{it} + \alpha_{1i} - \beta_{i1} Duration_{i,t} * \Delta R_{ft} - \beta_{i2} Duration_{i,t} * \Delta S \,\&\, P\ Index_t\right)^2 \\
& + \sum_2 Ln \frac{1}{(2\pi\sigma_i^2)^{1/2}} \\
& - \sum_2 \frac{1}{2\sigma_i^2}\left(R_{it} + \alpha_{2i} - \beta_{i1} Duratiojn_{i,t} * \Delta R_{ft} - \beta_{i2} Duration_{i,t} * \Delta S \,\&\, P\ Index_t\right)^2 \\
& + \sum_0 Ln\left(\Phi_{2,i} - \Phi_{1,i}\right)
\end{aligned}
\qquad (2)
$$

Where $\Phi_{j,i}$ represents the cumulative distribution function for each bond-year evaluated at

$$\left(\alpha_{ji} - \beta_{i1} Duration_{i,t} * \Delta R_{ft} - \beta_{i2} Duration_{i,t} * \Delta S \,\&\, P\ Index_t\right)/\sigma_i$$

$\sum_1 (region\ 1)$ represents the negative nonzero measured returns

$\sum_2 (region\ 2)$ represents the positive nonzero measured returns

$\sum_0 (region\ 0)$ represents the zero measured returns

σ_i is volatility of bond-year i.

R_{it} is return of bond-year i on day t[2].

ΔR_{ft} is the daily change in the 10-year risk-free interest rate on day t.

α_{1i} is sell-side cost of bond-year i.

α_{2i} is buy-side cost of bond-year i.

$Duration_{i,t}$ is Macaulay's duration of bond-year i on day t.

$\Delta S\&P\ Index_t$ is return on the Standard & Poor's 500 index on day t.

For purposes of liquidity estimation, this measure focuses only on the α_{2i} and α_{1i} estimates. Differencing the buy-side and sell-side cost estimates, $\alpha_{2i} - \alpha_{1i}$, represents the round-trip transaction costs.

$$LOT_i = \alpha_{2i} - \alpha_{1i} \quad (3)$$

Note that these two approaches will be used in calculating liquidity when the corporate bond in a given bond-year has daily clean price at least 2 months.

Chen, Lesmond and Wei (2007) and Hund and Lesmond (2008) find that both the percentage of zero returns and the LOT measure are indeed capturing liquidity, and capturing it effectively, with the LOT estimation being a far more powerful measure of liquidity costs. Therefore, this study uses the LOT measure as a main approach in measuring liquidity.

3.2.2 Default measures

This study uses two approaches in measuring default, which is the probability of default and credit scoring.

Probability of default

This study calculates probability of default by using Merton model. This approach measures default risk better than ordinal rankings because the probability of default provides more accurate forward-looking and provides frequent updates and early warning of changes in credit quality. To figure out the value of the probability of default (PD), Merton uses the following equation:

[2] The return of bond-year i on day t can be calculated by using the following formula;

$$R_{i,t} = \frac{P_{i,t} + A_{i,t} + C_{i,t}}{P_{i,t-1} + A_{i,t-1}} - 1$$

$$V_{it} = \frac{E_{it} + D_{it}e^{-rT}N(d_{2it})}{N(d_{1it})} \quad (4)$$

$$d_{1it} = \frac{\ln\left(\frac{V_{it}}{D_{it}}\right) + \left\{\left(r + \frac{1}{2}\sigma_{Vit}^2\right)T\right\}}{\sigma_{Vit}\sqrt{T}} \quad (5)$$

$$d_{2it} = d_{1it} - \sigma_{Vit}\sqrt{T} \quad (6)$$

$$PD_{it} = 1\text{-}N(d_{2it}) \quad (7)$$

Where E_{it} is market value of firm that issue bond i year t.

V_{it} is asset value of firm that issue bond i year t.

D_{it} is default point of firm that issue bond i year t.

r is three-month Treasury bill rate.

T is the length of time.

σ_{Eit} is volatility of stock's returns (per year) of firm that issue bond i year t.

σ_{Vit} is volatility of asset's returns (per year) of firm that issue bond i year t.

Note that this study calculates the initial asset value of firm from market equity plus book value of total liabilities. Moreover, this study uses rule of thumb in calculating default point. The default point is given by

$$D_{ti} = STD_{it} + \frac{1}{2}LTD_{it} \quad (8)$$

Where STD_{it} is short-term debt of firm that issue bond i year t.

LTD_{it} is long-term debt of firm that issue bond i year t.

The default bonds are not always available for all bonds or for all-time periods; thus, this study uses probability that its rating will be downgrade for a comparison with probability of default.

Credit scoring

The credit scoring identifies certain key factors that determine the probability of default and then weight them into a quantitative score. This study uses the binary probit technique in estimating the weight. This study estimates credit scoring for bond that its rating will be downgrade over the next year (Z). The probit model is given by

$$Z_{i,t} = P_{t-1}(Y^*_{i,t} = 1 \mid X_{i,t-1}, \beta) = \beta' X_{i,t-1} + \varepsilon_{i,t-1} \quad (9)$$

Where $Y_{i,t}^{*}$ is an indicator for credit rating of bond-year i is downgrade in that year (t).

$$Y_{i,t}^{*} = \begin{cases} 1 & \textit{If credit rating of bond is downgrade} \\ 0 & \textit{Otherwise} \end{cases}$$

$X_{i,t-1}$ is the vectors of the explanatory variables of bond-year i in the previous year (t-1).

β' is the transpose of the parameter vector of the explanatory variables.

This study uses explanatory variables in credit scoring based on Shumway (2001). The explanatory variables in this study are profitability (NITA: net income relative to total assets), leverage (TLTA: total liabilities relative to total assets), and market-based variables (EXRET: the monthly log excess return on each firm's equity relative to the S&P 500 index, SIGMA: the standard deviation of each firm's daily stock return over the past three months, and RSIZE: the relative size of each firm measured as the log ratio of its market capitalization to that of the market index)[3]. The results are presented in appendix A.

Credit scoring uses accounting variables in creating a major impediment in predicting the probability that bond rating will be downgraded over the next year. The frequency of accounting-based variables will be annualized because they are obtained exclusively from annually-issued financial statements, i.e. from balance sheets or income statements. Therefore, the probability that bond rating will be downgraded over the next year of a firm would be unchanged for 12 months when a prediction is based on a certain year's annual financial statement (Altman and Saunders (1998)). In other words, no matter when we estimate the default risk of a firm, the probability that bond rating will be downgraded over the next year is always identical during the given fiscal year because it is based on the same accounting variables, unless new or additional accounting information for the next fiscal year becomes available. On the other hand, Merton's model uses market information in predicting the probability of default; thus, probability of default from Merton's model can be predicted current risk

[3] All of these explanatory variables are definded as follows:
The NITA is the ratio of net income relative to adjusted total assets, which are calculated from total asset plus 0.1 of the result of difference between market equity and book equity.
The TLTA is the ratio of total liabilities relative to adjusted total assets.
The EXRET is the difference between natural logarithm of the sum of 1 and stock return and natural logarithm of the sum of 1 and market return.
The RSIZE is the natural logarithm ratio of firm market equity relative to total market value.

more accurate than credit scoring. Therefore, this study uses probability of default from Merton's model as a main approach in measuring default.

3.2.3 Liquidity and default effect on yield spreads

Whether liquidity or default risk is the main factor that drives corporate bonds yield spread is investigated by running yield spreads against liquidity risk, default risk, and control variables on both levels and changes. This study employs a list of independent variables used in Hund and Lesmond (2008) except default risk this study uses either probability of default or credit scoring. The regression is generally stated as:

$$\begin{aligned} Yield\ spread_{ijt} = {} & \eta_0 + \eta_1 Liquidity_{it} + \eta_2 Default_{it} + \eta_3 Maturity_{it} \\ & + \eta_4 Age_{it} + \eta_5 Amount\ outstanding_{it} + \eta_6 Coupon_{it} \\ & + \eta_7 T\text{-}Note_t + \eta_8 Term\ slope_t + \eta_9 Eurodollar_t \\ & + \eta_{10} Corruption\ perception\ index_{jt} + \eta_{11}\ Law\ dummy\ 1_{jt} \\ & + \eta_{12}\ Law\ dummy\ 2_{jt} + \eta_{13} Inflation_{jt} \\ & + \eta_{14} External\ balances_{jt} + \eta_{15} Total\ reserves/GDP_{jt} \\ & + \eta_{16} Total\ debt/Total\ exports_{jt} + \eta_{17} Total\ trade/GDP_{jt} \\ & + \varepsilon_{ijt} \end{aligned} \quad (10\ a)$$

$$\begin{aligned} \Delta(Yield\ spread)_{ijt} = {} & \gamma_0 + \gamma_1 \Delta(Liquidity)_{it} + \gamma_2 \Delta(Default)_{it} \\ & + \gamma_3 \Delta(T\text{-}Note)_t + \gamma_4 \Delta(Term\ slope)_t + \gamma_5 \Delta(Eurodollar)_t \\ & + \gamma_6\ \Delta(Corruption\ perception\ index)_{jt} + \gamma_7 \Delta(Inflation)_{jt} \\ & + \gamma_8 \Delta(External\ balances)_{jt} + \gamma_9 \Delta(Total\ reserves/GDP)_{jt} \\ & + \gamma_{10} \Delta(Total\ debt/Total\ exports)_{jt} \\ & + \gamma_{11} \Delta(Total\ trade/GDP)_{jt} + \varepsilon_{ijt} \end{aligned} \quad (10\ b)$$

Where $Yield\ spread_{ijt}$ is the yield spread of bond-year i in country j in that year (t).

$Liquidity_{it}$ is either one of two possible measures: the percentage of zero returns or the LOT measure of bond-year i in that year (t).

$Default_{it}$ is either one of two possible measures: probability of default or credit scoring of bond-year i in that year (t).

$Maturity_{it}$ is maturity of bond-year i in that year (t).

Age_{it}	is age of bond-year i in that year (t).
$Amount\ outstanding_{it}$	is amount outstanding of bond-year i in that year (t).
$Coupon_{it}$	is coupon rate of bond-year i in that year (t).
$T\text{-}Note_t$	is 1-year Treasury note rate in that year (t).
$Term\ slope_t$	is the difference between the 10-year and 2-year Treasury rates (the slope of the UST term structure) in that year (t).
$Eurodollar_t$	is the difference between the 30-day Eurodollar deposits and 3-month Treasury bill rate that controls for other potential liquidity effects on corporate bonds relative to Treasury bonds in that year (t).
$Corruption\ perception\ index_{jt}$	is corruption perception index in country j in that year (t).
$Law\ dummy\ 1_{jt}$	is legal origin dummy in country j in that year (t) (set to one for English/code law countries and zero for other).
$Law\ dummy\ 2_{jt}$	is legal origin dummy in country j in that year (t) (set to one for French/code law countries and zero for other).
$Inflation_{jt}$	is the inflation in country j in that year (t).
$External\ balances_{jt}$	is external balance on the current account as a percentage of GDP in country j in that year (t).
$Total\ reserves/GDP_{jt}$	is the ratio of total reserves minus gold to GDP in country j in that year (t).
$Total\ debt/Total\ exports_{jt}$	is the ratio total debt to total exports in country j in that year (t).
$Total\ trade/GDP_{jt}$	is the ratio of total export plus total import to GDP in country j in that year (t).
Δ	represents the first difference (yearly difference) in each variable.

These regression have specific control variables which are bond characteristics, political risk for the issuing country, U.S. macroeconomic risk, and macroeconomic and development variables for the issuing country. This study bases on Hund and Lesmond (2008) in the choice of yield spread determinants except default risk that uses either probability of default or credit scoring. This study uses corruption perception index (CPI) as a proxy of political risk for the issuing country.

3.2.4 Liquidity and default risks

In this part, this study investigates whether liquidity and default risks are consistent factor with yield spreads. This study constructs bond portfolios by using liquidity and default measures criteria. In constructing bond portfolios for testing whether liquidity risk is a consistent factor with yield spreads, this study controls or holds default risk constant by using probability of default for considering only the liquidity effect (ceteris paribus) because corporate bonds have two risk factors which are liquidity and default risks. This study sorts bonds into below and above median according to their default probability. In each default portfolio, this study sorts bonds into below and above median according to their LOT measure in order to measure premium from illiquid bonds. On the contrary, when this study constructs bond portfolios for testing whether default risk is a consistent factor with yield spreads, this study controls or holds liquidity risk constant by using the LOT measure for considering only the default effect. This study sorts bonds into below and above median according to their LOT measure. In each liquidity portfolio, this study sorts bonds into below and above median according to their probability of default in order to measure premium from distress bonds. Each January from 1998 through 2007, the model is re-estimated using only historically available data to eliminate look-ahead bias. Turnover costs and the effects of bid-ask bounces are minimized by holding the portfolios for a year.

After bond portfolios are constructed, this study ranks bond portfolios from less to more illiquid and from less to more default risk. To test whether liquidity and default risks are consistent with yield spreads, this study runs regression of these portfolios against common measures of systematic risk factors. The common measures of systematic risk factors in the regression base on Fama and French (1993). This study assumes that the Fama and French (1993) pricing model is not

misspecified model. According to Fama and French (1993), factor loading of bond returns are unexpected changes in interest rates or the maturity premium (TERM) and default premium (DEF). Therefore, this study can test whether liquidity risk is consistent with yield spreads by run the following regression.

$$Yield\ spread_{it} = \alpha + mTERM_t + dDEF_t + \varepsilon_{it} \quad (11)$$

Where $Yield\ spread_{it}$ denotes the yield spread of bond-year i on day t.

$TERM_t$ denotes portfolio of long-term U.S. government bonds – portfolio of short-term U.S. government bonds on day t.

DEF_t denotes long a portfolio of BAA-rated bonds, short a portfolio of AAA-rated bonds on day t.

This study uses average alpha of each portfolio in testing whether liquidity and default risks are consistent factors with yield spreads.

CHAPTER IV
RESULTS

4.1 Summary Statistics and Initial Comparisons

Our dataset of international market bonds are composed of 1,841 bonds issued by 522 issuers in five countries consisting of Canada, France, Japan, United Kingdom, and United States) over the period 1997-2007, and comprises a total of 8,145 bond-years. Table 2 contains the summary statistics of corporate bond data and issuer characteristics. Included in Table 2 are means, maximum, minimum, standard deviation and sample sizes for both corporate bond data and issuer characteristics.

The descriptive statistics in Table 3 presents the result of examining the general trend in the corporate bonds yield spread, liquidity risk, and default risk which are sorted into quartiles according to their yield spread. The results in Table 3 presented coincide with intuition that both liquidity estimates and default estimates are increasing with the yield spread. This result indicates that as yield spread increase, liquidity estimates and default estimates are also increase. However, liquidity estimates (both the percentage of zero returns and the LOT measure) appear to small decrease when yield spread increases from quartile 1 to quartile 2. This implies that when corporate bonds have low liquidity risk, investors do not concern liquidity risk.

Table 2: Summary statistics

This table reports summary statistics of corporate bond data (amount outstanding, coupon rate, and tenure) and issuer characteristics (leverage (total liabilities relative to total assets), profitability (net income relative to total assets), and annualized excess return (the yearly log excess return on each firm's equity relative to the S&P 500 index)) during the period 1997 to 2007. The sample contains 1,841 bonds from 522 issuers. Bp stands for basis points and N is the sample size.

Variable	Mean	Max	Min	St. Dev	N
Corporate bond					
Amount outstanding (millions)	299.1214	850.0000	11.0120	215.7022	1,841
Coupon (bp)	697.2729	975.0000	450.0000	141.5357	1,841
Tenure	15.2772	30.0528	6.0528	8.8903	1,841
Issuer characteristics (over 1997-2007)					
Leverage	0.6628	0.9251	0.4272	0.1385	2,693
Profitability	0.0464	0.1379	-0.0486	0.0459	2,693
Excess return (%)	0.1500	29.8924	-28.5003	15.1730	2,693

Table 3: Comparison of yield spread, liquidity measures and default measures

This table presents yield spread, liquidity measures and default measures statistics for corporate bonds from 1997 to 2007. The yield spread is the difference between the bond yield and the yield of a comparable maturity treasury bond as determined from DataStream. The percentage of zero returns (% Zero) is the percentage of daily returns that are equal to zero in a given bond-year. LOT refers to the modified Lesmond, Ogden, and Trzcinka (1999) model's liquidity estimate. Probability of default is the default estimate from Merton's model. Credit scoring refers to a number related to the probability that bond rating will be downgraded over the next year estimated from probit model, which uses explanatory variables follow Shumway (2001). Corporate bonds are sorted into quartiles according to their yield spread. Bp stands for basis points and N is the sample size.

	Yield spread (bp)	Liquidity		Default	
		% Zero (%)	LOT (bp)	Probability of default	Credit scoring
1 st quartile of yield spread					
Mean	59.1952	11.2205	84.3197	0.0005	0.0828
Max	89.5000	99.6183	1,014.7335	0.5205	0.9923
Min	31.4200	3.0651	0.0000	0.0000	0.0008
St. Dev	19.2896	22.9075	228.7947	0.0120	0.0776
N	2,038	2,038	2,038	2,017	1,701
2 nd quartile of yield spread					
Mean	114.6143	10.1802	64.9906	0.0012	0.0956
Max	144.4000	99.6183	1,052.7870	0.9443	1.0000
Min	89.6000	2.6820	0.0000	0.0000	0.0001
St. Dev	15.5707	20.9848	197.0312	0.0300	0.0984
N	2,035	2,035	2,035	2,004	1,821
3 rd quartile of yield spread					
Mean	190.7314	25.9152	178.3403	0.0068	0.1284
Max	250.4000	99.6183	1,010.0421	0.9443	1.0000
Min	144.5000	2.6820	0.0000	0.0000	0.0001
St. Dev	30.3029	33.5136	313.4633	0.0634	0.1412
N	2,038	2,038	2,038	1,958	1,757
4 th quartile of yield spread					
Mean	376.5356	58.0366	427.8362	0.0113	0.1936
Max	511.5600	99.6183	1,115.8901	0.6317	1.0000
Min	250.5000	2.6820	0.0000	0.0000	0.0000
St. Dev	92.0454	35.4756	381.8695	0.0484	0.1816
N	2,034	2,034	2,034	1,905	1,700

4.2 Liquidity and Default Effect on Yield Spreads

Many various theoretical models are applied to test in both liquidity and default effect on yield spreads. Amihud and Mendelson (1986) predict that investors demand higher expected returns for more illiquid or more default risk assets to compensate for the liquidity or default risk. This implies that, for the same cash flows in the future, more illiquid or more default risk assets will have lower prices. Since bond yield is a promised yield given known cash flows, the lower prices of more illiquid or more default risk bonds lead to higher bond yields and higher yield spreads, ceteris paribus. This study tests this theoretical prediction by investigating whether liquidity or default risk is the main factor that drives corporate bonds yield spread in accordance with running yield spreads against liquidity risk, default risk, and control variables. The result from regression is shown in Table 4. The number of bonds in each specification differs due to the various requirements for computing the liquidity measures and default measures. The conclusive result in Table 4 is the positive, significant coefficient for all liquidity and default variables. This result indicates that both liquidity and default risks are the main factor that drives corporate bonds yield spread.

Moreover, this study extends to investigate whether changes in liquidity or default risk is the main factor that drives corporate bonds yield spread changes. The results are presented in Panel A of Table 5. For all liquidity variables, an increase in both the percentage of zero returns and the LOT measure are significantly and positively associated with an increase in yield spreads. On the contrary, this study finds that an increase in probability of default is insignificantly associated with an increase in yield spread changes and an increase in credit scoring is significantly and negatively associated with an increase in yield spread changes. The sign of changes in credit scoring coefficient is wrong, implying that credit scoring is wrong model for predict changes in probability that bond rating will be downgraded over the next year. These results indicate that only changes in liquidity is the main factor that drives corporate bonds yield spread changes.

Unit of liquidity and default measures are different; therefore, change in one measure might has a greater effect on the changes in yield spread than other measure. Standardized coefficients are used for deciding which of changes in liquidity or default risk has a greater effect on the changes in yield spread. The standardized

regression coefficients represent in determining whether one standard deviation change in one independent variable produces more of a change in relatively position than one standard deviation change in another independent variable. The standardized coefficients of each measure are presented in Panel B of Table 5. The results in Panel B of Table 5 presented changes in the LOT measure has a greater relative effect on the changes in yield spread while changes in probability of default has a smaller effect on the changes in yield spread. Therefore, in terms of the standardized variables, the liquidity change has a greater effect on the yield spread change than default change.

4.3 Liquidity and Default Risks

Whether liquidity and default risks are a consistent factor with yield spreads in an international market, they are investigated by running regression of value-weighted yield spreads on common measures of systematic risk factors. This study uses average alpha of each portfolio for indicating investment performance of portfolios sorted on liquidity risk and default risk. Panel A of Table 6 presents the results of portfolios sorted on liquidity risk. Each portfolio corresponds to one column of the table. As shown in Panel A of Table 6, all portfolios have statistically significant alphas. In addition, the alphas increase as the portfolios proceed from less to more illiquid in both below and above median of default portfolios. Thus, liquidity risk is a consistent factor with yield spreads in an international market.

The results of portfolios sorted on default risk are reported in Panel B of Table 6. The alphas are significantly and positively associated with yield spreads and strongly increase in default risk in both below and above median of liquidity portfolios. This result indicates that default risk is consistent with yield spreads in an international market.

Table 4: Yield spread determinants, liquidity measures and default measures tests

The yield spread determinants are based on bond-specific variables (maturity, age, amount outstanding, and coupon rate), U.S. macroeconomic variables (1-year Treasury note rate (T-Note), the difference between the 10-year and 2-year Treasury note rates (Term slope), and the 30-day Eurodollar rate minus the 3-month Treasury bill rate (Eurodollar)), political risk variable (corruption perception index (CPI) rankings range from zero to 10 with lower political risk ratings indicating reduced political stability), code/civil dummy (law dummy 1 is set to one for English/code law countries and zero for other and law dummy 2 is set to one for French/code law countries and zero for other), business cycle variable (inflation), and the country macro economic variables of external balance of goods, the total reserves, and the total debt service all as a percentage of GDP and the total debt to total exports. The liquidity cost estimates are based on the percentage of zero returns (% Zero) and the modified LOT model. Default risk is based on probability of default from Merton's model and credit scoring refers to a number related to the probability that bond rating will be downgraded over the next year estimated from probit model, which uses explanatory variables follow Shumway (2001). White's (1980) t-statistics are presented in parentheses. An * or ** signifies significance at 5% or 1% level, respectively. Bp stands for basis points and N is the sample size.

Variable	(1)	(2)	(3)	(4)
Intercept	201.3510**	29.1441	253.3611**	86.3579
	(3.99)	(0.37)	(4.79)	(1.03)
% Zero	1.4829**	1.4757**		
	(40.48)	(40.64)		
LOT (bp)			0.1063**	0.1068**
			(27.51)	(28.04)
Probability of default	192.3468**		236.1488**	
	(8.12)		(9.50)	
Credit scoring		178.3277**		196.9536**
		(23.36)		(24.57)
Maturity	1.5610**	1.4843**	1.2801**	1.2327**
	(11.54)	(11.03)	(9.02)	(8.69)
Age	-6.6977**	-6.1615**	-9.4419**	-8.9098**
	(-17.99)	(-16.34)	(-24.99)	(-23.21)
Amount outstanding	0.0000**	0.0000**	0.0000**	0.0000**
	(-9.58)	(-10.12)	(-11.24)	(-11.94)
Coupon (bp)	0.3651**	0.3493**	0.4462**	0.4276**
	(38.03)	(35.93)	(46.30)	(43.55)
T-Note (bp)	0.0232	0.1385**	-0.0358	0.0946
	(0.58)	(2.82)	(-0.86)	(1.83)
Term slope (bp)	0.2363**	0.4006**	0.1230*	0.3073**
	(3.95)	(5.54)	(1.96)	(4.04)
Eurodollar (bp)	-0.2472**	-0.2990**	-0.1658*	-0.2298**
	(-3.89)	(-4.35)	(-2.49)	(-3.17)
Corruption perception index	-59.1884**	-46.0297**	-65.4653**	-53.2410**
	(-7.78)	(-4.33)	(-8.19)	(-4.75)
Law dummy 1	139.4682**	137.7187**	141.1624**	141.5183**
	(7.29)	(4.47)	(7.03)	(4.35)
Law dummy 2	34.3394	32.0616	70.4505**	70.8895*
	(1.62)	(1.00)	(3.18)	(2.10)
Inflation (bp)	-0.0938**	-0.0333	-0.0823**	-0.0227
	(-5.73)	(-1.50)	(-4.79)	(-0.97)

Variable	(1)	(2)	(3)	(4)
External balances (%)	3.1480	-29.2763**	0.8795	-32.4179**
	(0.56)	(-3.18)	(0.15)	(-3.34)
Total reserves/GDP (%)	7.9232**	8.4090**	9.7526**	10.1848**
	(7.36)	(5.17)	(8.65)	(5.95)
Total debt/ total exports	14.8363**	10.5157	13.2426**	2.1462
	(3.08)	(1.26)	(2.62)	(0.24)
Total trade/GDP (%)	-0.2134	1.9253**	-0.2430	1.8898*
	(-0.47)	(2.65)	(-0.51)	(2.47)
N	7,884	6,979	7,884	6,979
Adj R square	0.5234	0.5722	0.4747	0.5245

Table 5: Yield spread change determinants, liquidity measures and default measures tests

The yield spread change determinants are based on U.S. macroeconomic variables (1-year Treasury note rate (T-Note), the difference between the 10-year and 2-year Treasury note rates (Term slope), and the 30-day Eurodollar rate minus the 3-month Treasury bill rate (Eurodollar)), political risk variable (corruption perception index (CPI) rankings range from zero to 10 with lower political risk ratings indicating reduced political stability), business cycle variable (inflation), and the country macro economic variables of external balance of goods, the total reserves, and the total debt service all as a percentage of GDP and the total debt to total exports. Annual changes in all variables are examined for the 1998-2007 period. The liquidity cost estimates are based on the percentage of zero returns (% Zero) and the modified LOT model. Default risk is based on probability of default from Merton's model and credit scoring refers to a number related to the probability that bond rating will be downgraded over the next year estimated from probit model, which uses explanatory variables follow Shumway (2001). Panel A reports the regression of the change in the yield spread on the change in liquidity measures, the change in default measures and other yield spread change controls. Panel B reports standardized regression coefficients of the change in the yield spread on the change in liquidity measures, the change in default measures and other yield spread change controls. White's (1980) t-statistics are presented in parentheses. An * or ** signifies significance at 5% or 1% level, respectively. Bp stands for basis points and N is the sample size.

Variable	(1)	(2)	(3)	(4)
Panel A: Regression of the Change in the Yield Spread on the Change in Liquidity Measures, the Change in Default Measures and Control Variables				
Intercept	-21.8261**	-32.9946**	-22.1800**	-33.2742**
	(-19.95)	(-24.29)	(-20.32)	(-24.57)
Δ(% Zero)	0.3303**	0.2465**		
	(6.45)	(4.62)		
Δ(LOT) (bp)			0.0375**	0.0319**
			(9.12)	(7.67)
Δ(Probability of default)	22.8859		23.5616	
	(1.60)		(1.66)	
Δ(Credit scoring)		-37.1469**		-36.9563**
		(-7.06)		(-7.05)
Δ(T-Note) (bp)	0.2164**	0.1199**	0.2106**	0.1183**
	(9.08)	(3.42)	(8.87)	(3.39)
Δ(Term slope) (bp)	0.2769**	0.0364	0.2681**	0.0339
	(7.44)	(0.67)	(7.23)	(0.63)
Δ(Eurodollar) (bp)	-0.0149	0.1015**	-0.0064	0.1069**
	(-0.44)	(2.62)	(-0.19)	(2.77)
Δ(Corruption perception index)	-50.9637**	-99.4087**	-50.5426**	-98.4921**
	(-9.57)	(-11.94)	(-9.52)	(-11.88)
Δ(Inflation) (bp)	-0.1143**	-0.1666**	-0.1136**	-0.1655**
	(-12.00)	(-11.58)	(-11.97)	(-11.55)
Δ(External balances) (%)	16.4961**	1.7964	16.2158**	1.6140
	(4.24)	(0.27)	(4.19)	(0.24)
Δ(Total reserves/GDP) (%)	12.7995**	17.7204**	13.1600**	18.0161**
	(7.78)	(6.84)	(8.03)	(6.97)
Δ(Total debt/ total exports)	-72.1304**	-68.5143**	-73.5186**	-70.5328**
	(-16.28)	(-12.23)	(-16.66)	(-12.64)
Δ(Total trade/GDP) (%)	-12.7338**	-18.2091**	-12.7131**	-18.0487**
	(-9.13)	(-7.42)	(-9.15)	(-7.38)
N	6,084	5,203	6,084	5,203
Adj R Square	0.1177	0.1503	0.1237	0.1563

Variable	(1)	(2)	(3)	(4)
Panel B: Standardized Regression Coefficients of the Change in the Yield Spread on the Change in Liquidity Measures, the Change in Default Measures and Other Yield Spread Change Controls.				
Δ(% Zero)	0.0781	0.0596		
Δ(LOT) (bp)			0.1103	0.0985
Δ(Probability of default)	0.0195		0.0201	
Δ(Credit scoring)		-0.0928		-0.0924
Δ(T-Note) (bp)	0.4058	0.2187	0.3950	0.2157
Δ(Term slope) (bp)	0.3411	0.0448	0.3302	0.0417
Δ(Eurodollar) (bp)	-0.0064	0.0445	-0.0028	0.0469
Δ(Corruption perception index)	-0.1589	-0.2890	-0.1576	-0.2864
Δ(Inflation) (bp)	-0.2015	-0.2867	-0.2003	-0.2848
Δ(External balances) (%)	0.0664	0.0051	0.0653	0.0046
Δ(Total reserves/GDP) (%)	0.1025	0.0969	0.1054	0.0985
Δ(Total debt/ total exports)	-0.2203	-0.2042	-0.2245	-0.2102
Δ(Total trade/GDP) (%)	-0.1530	-0.1687	-0.1528	-0.1672

Table 6: Returns on liquidity and default risks sorted bond portfolios

In panel A, at the beginning of each year from 1998 to 2007, bonds are sorted into below and above median based on probability of default from Merton's model for controlling default risk constant. In each default portfolio, bonds are sorted into below and above median based on the modified LOT model in order to measure premium from illiquid bonds. In panel B, at the beginning of each year from 1998 to 2007, bonds are sorted into below and above median based on the modified LOT model for controlling liquidity risk constant. In each liquidity portfolio, bonds are sorted into below and above median based on probability of default from Merton's model in order to measure premium from distress bonds. Panel A and B report results from regressions of value weighted yield spread on common measures of systematic risk factors. The common measures of systematic risk factors in the regression base on Fama and French (1993). The factor loading of the yield spread are maturity premium (the difference between portfolio of long-term U.S. government bonds and portfolio of short-term U.S. government bonds (Term)) and default premium (the difference between portfolio of BAA-rated bonds and portfolio of AAA-rated bonds (Def)). The average of the yearly coefficient estimates are displayed. The numbers in parentheses are Fama and MacBeth (1973) t-statistics, computed as the average coefficient estimate divided by the result of the standard deviation of the coefficient estimates divided by the number of years in the period. Adj R Square is the average adjusted R Square across the yearly regressions. An * or ** signifies significance at 5% or 1% level, respectively. Bp stands for basis points and N is the sample size.

Variable	Low probability of default		High probability of default	
	Low LOT	High LOT	Low LOT	High LOT
Panel A: Portfolios sorted on liquidity risk				
Alpha	45.2340**	106.4735**	138.8939**	201.7301**
	(11.13)	(5.19)	(4.30)	(3.87)
Term (bp)	0.0822**	-0.0406	-0.1184	-0.1190
	(4.90)	(-0.96)	(-1.78)	(-1.07)
Def (bp)	0.2711**	0.5814**	0.6948**	0.8619**
	(6.08)	(6.18)	(6.36)	(6.85)
N	695,468	257,758	496,130	449,100
Adj R Square	0.0401	0.0588	0.0205	0.0375
Panel B: Portfolios sorted on default risk				
Alpha	50.7618**	141.9429**	116.7216**	225.7810**
	(11.00)	(4.27)	(6.03)	(4.05)
Term (bp)	0.0878**	-0.1241	-0.0416	-0.1435
	(5.19)	(-1.87)	(-0.99)	(-1.19)
Def (bp)	0.2881**	0.5940**	0.6234**	0.9043**
	(6.54)	(5.92)	(6.82)	(6.40)
N	614,196	544,302	373,613	366,345
Adj R Square	0.0400	0.0185	0.0572	0.0377

CHAPTER V
CONCLUSION

Many studies claim that liquidity and default risks are important factors that have effect on corporate bonds yield spread. Most previous papers try to answer the question on which factors between liquidity and default risks that is better in explaining yield spreads. Some papers support liquidity risk as better representative than default risk but some do not. Thus, this study sets up the research question that whether liquidity or default risk is the key factor that drives corporate bonds yield spread in an international market consisting of Canada, France, Japan, United Kingdom, and United States. This study finds that both liquidity and default risks are significantly and positively associated with yield spreads. Extending the study to changes in yield spread, this study finds that only an increase in liquidity risk is significantly and positively associated with an increase in yield spreads. This implies that both liquidity and default risks are the key factors that drive corporate bonds yield spread and only changes in liquidity is the key factor that drives changes in yield spread in an international market.

Moreover, this study uses probability of default and credit scoring instead of credit rating in measuring the size of the default component in yield spreads. Both probability of default and credit scoring are more appropriate approaches since they reflect default risk and provide better performance of default prediction in short investment horizons than credit rating.

Recently, Chacko (2005) investigates whether liquidity risk is consistent with yield spreads by measuring each bond issue's liquidity from its weighted average turnover value in US corporate bond markets. Moreover, Zhang (2007) investigates whether default risk is consistent with yield spreads by measuring each bond issue's default from its probability of default in US corporate bond markets. They conclude that the pattern of the alphas is strongly important in pricing liquidity and default risks. This study uses more extensive data than that of previous papers by using sample data in the various international markets used as representative of bond markets around the world. Additionally, this study controls liquidity risk in order to examine whether liquidity risk is consistent with yield spreads better than Chacko (2005); thus, the result from this study can present more accuracy than Chacko

(2005). This study finds that the alphas are significantly and positively associated with yield spreads and strongly increase as the portfolios proceed from less to more liquidity risk and less to more default risk. It can be concluded that both liquidity and default risks are consistent with yield spreads in an international market.

References

Altman, E.; and Rijken, H. 2004. How rating agencies achieve rating stability. Journal of Banking & Finance 28: 2679–2714.

Altman, E.; and Rijken, H. 2006. A point-in-time perspective on through-the-cycle ratings. Financial Analysts Journal 62: 54-70.

Altman, E.; and Saunders, A. 1998. Credit Risk Measurement: Development over the Last 20 Years. Journal of Banking and Finance 21: 1721-1742.

Amihud, Y.; and Mendelson, H. 1986. Asset pricing and the bid-ask spread. Journal of Financial Economics 17: 223–249.

Amihud, Y.; and Mendelson, H. 1987. Trading mechanisms and stock returns: An empirical investigation. Journal of Finance 42: 533–553.

Bandyopadhyay, A. 2007. Mapping corporate drift towards default; Part 1: A market-based approach. The Journal of Risk Finance 8: 35–45.

Campbell, J.; Hilscher, J.; and Szilagyi, J. 2007. In search of distress risk. Working Paper, Harvard University.

Chacko, G. 2005. Liquidity risk in the corporate bond markets. Working Paper, Harvard University and State Street Global Markets.

Chen, L.; Lesmond, D.; and Wei, J. 2007. Corporate yield spreads and bond liquidity. Journal of Finance 62: 119–149.

Covitz, D.; and Downing, C. 2007. Liquidity or credit risk? The determinants of very short-term corporate yield spreads. Journal of Finance 62: 2303–2328.

Fama, E.; and French, K. 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33: 3–56.

Fama, E.; and French, K. 2002. Testing trade-off and pecking order predictions about dividends and debt. The Review of Financial Studies 15: 1–33.

Fama, E.; and MacBeth, J. 1973. Risk, return, and equilibrium: empirical tests. The Journal of Political Economy 81: 607–636.

Hund, J.; and Lesmond, D. 2008. Liquidity and credit risk in emerging debt markets. Working Paper, Tulane University.

La Porta, R.; Lopez-de-Silanes, F.; Shleifer, A.; and Vishny, R. 1999. The quality of government. The Journal of Law, Economics, and Organization 15: 222-279.

Landschoot, A. 2008. Determinants of yield spread dynamics: Euro versus US dollar corporate bonds. Journal of Banking & Finance 32: 2597–2605.

Lesmond, D.; Ogden, J.; and Trzcinka, C. 1999. A new estimate of transaction costs. Review of Financial Studies 12: 1113–1141.

Lesmond, D.; Schill, M.; and Zhou, C. 2004. The illusory nature of momentum profits. Journal of Financial Economics 71: 349–380.

Longstaff, F.; Mithal, S.; and Neis, E. 2005. Corporate yield spreads: Default risk or liquidity? New evidence from the credit-default swap market. Journal of Finance 60: 2213–2253.

Merton, R. 1974. On the pricing of corporate debt: The risk structure of interest rates. Journal of Finance 2: 449–470.

Shumway, T. 2001. Forecasting bankruptcy more accurately: A simple hazard model. Journal of Business 74: 101–124.

Zhang, A. 2007. Distress risk premia in stock and bond returns. Working Paper, University of Arizona.

APPENDICES

APPENDIX A

Credit scoring refers to a number related to the probability that bond rating will be downgraded over the next year estimated from probit model, which uses explanatory variables follow Shumway (2001).

Table A: Credit Rating Prediction

Credit rating prediction is provided for a binary probit model where the dependent variable is credit rating of bond and the independent variables are shown in the table. The sample period is from 1997 through 2007. The Z-statistics is reported in parentheses. An * or ** signifies significance at 5% or 1% level, respectively.

Variable	
Intercept	-1.7332**
	(-4.59)
NITA	-6.645**
	(-7.22)
TLTA	0.6976*
	(2.46)
EXRET	-0.7446**
	(-3.17)
SIGMA	0.5864*
	(1.99)
RSIZE	-0.0192
	(-0.39)
N	2,330
Rating Change	263
McFadden R-squared	0.0903

Table B: Prediction Success Matrix

A measure of the goodness of fit of the probit model follows Shumway (2001) variables that are estimated using a panel data sample from 1997 through 2007. This table presents the matrix of actual ratings versus predicted ratings.

Actual \ Predicted	change downgrade	not change downgrade	**Total**
change downgrade	28	235	**263**
not change downgrade	43	2,024	**2,067**
Total	**71**	**2,259**	**2,330**

Percentage of correct = 88.07%

Table C: Predictive Ability of Model on Out of Sample Test

This table presents the predictive accuracy of the model. In each case, the model is estimated with data from six years before and rolls over. The first column presents the estimated parameters period and the out sample period. The last column shows the percentage of correct.

Holdout Year	Percentage of Correct
2003 estimated parameters from 1997 - 2002	86.71%
2004 estimated parameters from 1998 - 2003	88.98%
2005 estimated parameters from 1999 - 2004	88.59%
2006 estimated parameters from 2000 - 2005	88.22%
2007 estimated parameters from 2001 - 2006	89.43%

APPENDIX B

Summary of variables

Variable	Description	Source
Dependent variables		
Z	Credit exposure that credit rating of bond-year i will be changed downgrade.	–
Yield spread	The difference between yield on the corporate bond and the U.S. Treasury bond closest matched to the bond's maturity.	DataStream
Independent variables		
NITA	Net income relative to total assets	DataStream
TLTA	Total liabilities relative to total assets	DataStream
EXRET	The monthly log excess return on each firm's equity relative to the S&P 500 index	DataStream
SIGMA	The standard deviation of each firm's daily stock return over the past three months	DataStream
RSIZE	The relative size of each firm measured as the log ratio of its market capitalization to that of the S&P 500 index	DataStream
Liquidity variables		
The percentage of zero returns (% Zero)	Liquidity cost	–
The LOT measure	Liquidity cost	–
Default variables		
Probability of default	Default risk	–
Credit scoring	Default risk	–
Control variables		
Maturity	Bond maturity	DataStream
Age	Age of bond	DataStream
Amount outstanding	Bond amount outstanding	DataStream
Coupon	Coupon rate	DataStream
T-Note	Yield on one-year Treasury note rate	The Federal Reserve Bank
Term slope	The difference between the 10-year and 2-year Treasury rates (the slope of the UST term structure)	The Federal Reserve Bank
Eurodollar	The difference between the 30-day Eurodollar deposits and 3-month Treasury bill rate that controls for other potential liquidity effects on corporate bonds relative to Treasury bonds	The Federal Reserve Bank
Corruption perception index	A comparative assessment of countries' integrity performance	Transparency International
Code/Civil Law Dummy	Legal origin dummy	LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (1999)
Inflation	Macroeconomic condition	the World Bank

Variable	Description	Source
External balances	External balance on the current account as a percentage of GDP	DataStream
Total reserves/GDP	Reserve liquidity (the ratio of total reserves minus gold to GDP)	DataStream and the World Bank
Total debt/total exports	The debt burden (the ratio total debt to total exports)	DataStream
Total trade/GDP	The openness of the economy (the ratio of total	the World Bank

Biography

Miss Punnipa Charoensriwattanakul graduated from Faculty of Commerce and Accountancy, Chulalongkorn University majoring in Insurance with Grade Average Point (GPA) equaled to 3.38, achieved Second Class Honor in 2007. In the same year, she entered to Full-Time program in Master of Science in Finance (MS Finance) at Faculty of Commerce and Accountancy, Chulalongkorn University. She graduated in academic year 2009 with GPA of 3.56.