THE DETERMINANTS OF THE FIRST ENTERING PUBLIC BOND MARKET: EVIDENCE FROM THAI LISTED COMPANIES

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

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ABSTRACT

This study applied the Cox Proportional Hazard Model to investigate the determinants of timing decision to issue the first public bond of firms in Stock Exchange of Thailand during year 1997-2007. The result is consistent with information asymmetry and flotation cost hypothesis. Firm size and the experience of issuing private bond firms can be used in explaining the decision of Thai firms to issue the public bond in the whole sample period and sub-period. The larger size firms and the firms that used to issue the private bond are more likely to issue the public bond. However, this study does not find the evidence supported the market timing hypothesis. Due to sub-period analysis, the market timing variables, GDP and NIPOB, fail to reveal significant impact on the decision to issue the first public bond.

I. INTRODUCTION

In general, firms have several choices to finance fund including from financial institutions and capital market by using debt and equity instruments. In Thailand, major long-term financing sources can be categorized into three primary sources: a) bank loan, which include long-term loans from all financial institutions; b) debt instruments; which consist of private placement bond and public bond c) equity instruments, which including the issue of common stock, warrants and unit trust to strategic partners, existing shareholders or the public respectively. After the 1997's economic crisis, bond market in Thailand is increasingly important source of fund for firms other than funding from bank. During the decade from 1998-2007, the bond market in Thailand has grown steadily at more than 5% annually. According to data from the Thai Bond Market Association (ThaiBMA), the value of the bond market is around 70% of the equity market value and 77% of the bank loans value in 2007. From table I, the size of domestic Thai bond market calculated by par value of outstanding domestic bond as of the last trading day of 2007 had increased to Baht 4,698.88 billion, with 25% of this amount contributing to the outstanding par value of new issued corporate bond as presented in Table II. In the primary bond market in 2007, the issued size of new corporate bonds totaled Baht 1,170.51 billion. Thus, the Thai corporate bond market is growing to the important source of fund for companies even magnitude of market is still small compared to other markets.

[Table I and II are here]

However, many firms in Thailand finance from bond market but some firms have no bond issue public in their capital structures, some have only private (bank or non-bank) long-term debt and some decide to access the public bond market at early of their life. In spite of there has been a lot of paper that concentrate on the initial public offering of firm's equity and has devoted to firm's relative use of bank and bond financing (including private bond and public bond) but nowadays little attention has been studied to the determinant of the time of firm's decision to issue their first public bond. Most of these studied in abroad market but it

never paper studies in Thai firms. The reasons that has no research on this topic for Thai firms are firms that issue bond to public in Thailand is rather less and is more difficult to collect data. At present there are only 20 firms (not including firms in rehabilitation, banking, finance and securities and insurance sector) from total Thai listed firms during 1997 to 2007 that issue bond to public as source of fund. It seem to be less but the number is increasingly especially after crisis in 1997.

In this study, we investigate the determinant of the timing to decision to initial public offering bond for Thai Listed Company by using Cox proportional hazard model. More specific, how firms size, credit quality of firms, growth opportunity of firms and experience from issue private bond. In addition, we add the bond market condition and that always used to determine the decision to IPO stocks as one of explanatory variables. For this study, the firm that we study is Thai listed firms in Stock Exchange of Thailand (excluding firms in rehabilitation, banking, finance and securities and insurance sector). The data in this study is quarterly data and obtain from Securities and Exchange Commission (SEC), and SET Market Analysis and Reporting Tool (SETSMART) as well as the ThaiBMA website. Sampling period is 11 years, 1997 to 2007, that are after the financial crisis. We do not include the convertible bond in this study since after financial crisis convertible bond from private sector in Thailand have rapidly lost favor and the determinant of the placement convertible bond may be different from similarly characteristic with equity.

The benefit of this study is to provide the understanding and implication about the factor that determine the timing of IPO bond specifically in Thai firms.

The remainder of the paper is organized as follows. Section II provides overview of previous related literatures relevant to our topic. Section III describes the theoretical background. Section IV presents the data employed, the preliminary data analysis and focuses on the methodology of hazard model. The empirical study and analysis of testing results will be in Section V. Finally, Section VI is conclusion.

II. LITERATURE REVIEW & THORETICAL FRAMEWORK

In the previous researches, the papers that study the timing of decision to issue the first public bond are rather less. Mostly, they often to focus on the choice to funding between bank loan and bond market or choice on private bond and public bond, in addition, more to focus on firms in U.S. country due to firms in European and Asia market are probably fund bank based system. In this section, we divide the literature into 5 parts following from four main theoretical points: information asymmetry and monitoring cost, agency cost, flexibility in the event of financial distress, flotation cost to debt issues and combination of these theories.

2.1 Information Asymmetry and Monitoring

The several previous studies investigate the choice of private and public debt found that information asymmetry and monitoring is the important factor for firms to decision offer the private or public debt. For instance, **Easterwood and Kadapakkam (1991)** who focus on the decision to funding of Fortune 500 firms between private debt and public debt, show that the medium size of firms finance fund from private debt more than lager firms. Since investors have less information than issuers about the true value of firms that go to public especially in the small firms. This information asymmetry is more serious obstruction for new and small firms to introduce the public bond into their capital structure than old and big firms since the investors has little track record and low visibility of new and small firms. From this reason, smaller firms are tended to have higher information asymmetry. **Fama (1985)** found that small firms have higher information asymmetry and tend to funding from bank loan and issuing private bond more than financing from issuing public bond. Since banks or private lenders have more efficient to monitor the borrowers including lower cost benefit in monitoring, banks can reduce the adverse selection problem. Contrast to **Diamond (1991) and Rajan (1992)** focus on the impact of banks' monitoring and firm's reputation on the choice between bank loans and directly placed debt and found that firms with high and low credit quality tend to issue bond directly than borrow from bank. Since high-credit quality firm or firms with high

reputation have lower cost of capital, they maintain the credit to undertake benefit from lower cost of capital. This point make these firms do not need monitoring from bank. While the low credit quality firms that they have less to loss if they reveal bad news about themselves. So the monitoring from bank is not necessary, then these firms tend to finance with bond financing rather than bank financing. **Denis and Mihov (2002)** is also found that choice of funding between public debt, private debt and bank loan is strongly related to the credit quality of firms, captured by Altman's Z-score and leverage. Firms with good credit quality record prefer to fund from public debt, firms with middle credit quality tend to borrow from bank and low credit quality firms go to finance from non-bank debt. This result is consistent with Diamond (1991). Similar also, **Hale and Santos (2007)** applied Cox proportional hazard model to investigate found that the firm reputation have affected on the timing of firm's decision to entering the public bond market. The firms with best and worst reputation which capture by Altman's Z-score as proxy of firm risk tend to enter the public bond market earlier than firms with intermediate reputation.

Following the literature based on information asymmetry and monitoring cost, the probability of issuing the public bond is increasing in size of firms, which is mostly measured by sale and total asset, and credit quality of firms, which is captured by leverage, Altman's Z-score and return on asset.

2.2 Agency Problem

The prior literatures show that agency problem is also one of the factors that effect the decision to use private or public debt. Firms with debt outstanding arise the agency problem between the debt holder and firms that cause the underinvestment problem and take more risky project. **Myers (1977)** found that firms with high growth of investment opportunities do not want to issue long term debt because they avoid the problem of committing the firm to share the benefits of growth with debt holders. In addition, they also found that high growth opportunities firms tend to finance from bank loan or private bond because closed relationship between bank (private lenders) and firms can protect firm from underinvestment in value projects and over invest in riskier projects. **Patel (2000)** also found

consistently with Myers in that growth opportunities captured by market to book ratio have negative relation with funding from public bond. Same as **Barclay and Smith (1995)** who study risk-shifting problem from incentive to taking the riskier project of shareholders and underinvestment problem found that these problems almost occur with high growth firms. **Krishnaswami et al. (1999)** also found that firms with high agency problem tend to borrow from bank or private debt to use benefit from good monitoring. The relation between growth opportunity and debt choice based on agency cost theory is not consistent as seeing from some researches. For example, **Johnson (1997, 2003)** found that growth opportunity has no relation with issuing public bond but have positive relation with issuing public bond including negative with bank loan. Since firms change maturity of debt to protect the underinvestment problem than change in debt sources. **Houston and Jame (1996)** find the result contrast to the agency cost in that firms with high opportunity tend to funding from bank rather less in case they have relationship with single bank while if firms have relationship with multiple bank, then growth firms tend to use public debt instead. Based on the studies of Thai data, they found that firms with high growth opportunity measured by market to book ratio have negative relation with the decision to issue the public bond. For example, **Udomchok (2005)** who studied the decision to issue security in the private and public market between January 1999 and June 2003 found that high growth firms have low probability to issue the public bond.

Based on Japanese firms, the result in some researches is contrast to the agency cost theory also. For example, **Hoshi et al (1993), Hori and Osano (2002), Shirasu and Xu (2007), and Arikawa (2008)** in that the growth opportunity of firms is one important factor to determine the choice of funding between public and private debt by Japanese firms since 1980s. They found that the growth opportunity of firms captured by Toin'q and market to book ratio have positive relationship with funding from public debt. Firms with high growth opportunity tend to funding from public bond. This resulting from firms with high growth and need more fund have incentive to avoid the hold-up problem from borrowing bank. In addition, Arikawa (2008) show that growth opportunity of firms' captured by Tobin'q and

market to book ratio give the similar result. Furthermore, Hoshi (1993) show that agency cost theory is consistent when firms are Keiretsu members (firms corporate many industry include bank, life and insurance firms and trading company and having powerful in Japanese economy). However, **Anderson and Makhija (1999)** found that high growth firms tend to use public bond than bank.

Following the literature based on agency problem, the probability of issuing the public bond is increasing in the growth opportunity of firms, which is mostly measured by market to book ratio and Tobin'q.

2.3 Flotation Costs

The studies based on flotation costs one of factors relative to funding private bond or public bond. Flotation costs include the direct expenses and indirect expenses of issue the bond. Direct expenses are the underwriter's spread, filing fees, legal fee. Indirect expenses include the management time on the new issue. Previous studies suggested that flotation cost of private bond is lower than public bond issuing, so most firms that issue the public bond are the large firm size. **Blackwell and Kidwell (1988)** found that firms issue public placement bond pay fee to investment banker more than issuing private bond. Since the more investors make more distribution cost also. From this reason, small firms that have the smaller demand of funding than large firms tend to finance fund from private bond. This hypothesis is confirmed by **Kadapakkam (1991) and Krishnaswami et al. (1999)** found that small firms and firms with low issuing size of bond don't get benefit from the economy of scale of flotation cost of issuing the public debt and have high proportion of private bond offering. Based on Japanese data also such Arikawa (2008) found consistent with U.S. data in that larger firms prefer to issue public bond more than small firms.

Based on the studies of Thai data they also found consistent with the U.S. data that are firm size have positive relation with the decision to issue the public bond. For example, **Udomchok (2005)** found that larger size of firms captured by the size of issue tend to issue the public bond.

Following the literature based on flotation cost suggest that the more in size of firms and issuing size of bond, the more in issuing the public bond.

2.4 Flexibility in the Event Financial Distress

The evidence from prior researches found that firms with high probability to bankruptcy including distress firms prefer to fund from private debt than public debt. For example, **Rajan (1992) and Cantillo and Wright (2000)** study the affect of bank's monitoring on firm's financing and found that firm with more likely to default or distress (e.g. low profitability, low and stable cash flow, and low collateral) prefer to use bank loan over entering the bond market since the capability of monitoring and reorganization skills of bank can help firm to survive. Consistent with **Berlin and Loeys (1998) and Chemmanur and Fulghieri (1994)** describe that probability to default or distress of borrowers determines the funding choice of firms. That are firms with high credit rating prefer to use public debt while intermediate credit rating firms tend to borrow from bank. **Denis and Mihov (2002)** find also that regulations and renegotiation with private loan are higher flexibility than public loan.

Based on Japanese data is rather consistent with theory and U.S based data such **Arikawa (2008)** show that firms with low default risk measure by total debt to total asset depend on bank or private bond than issuing the public bond since less cost to negotiate the loan contract when firms default.

From this view, they use as Altman's Z-score, interest coverage ratio and debt to asset as proxies of probability to distress.

2.5 Market Timing

The literatures on the initial public offering of equity show that the favorable market conditions associated with high investor optimism or economic expansion support firms to issue the initial public offering of equity. Thus, the favorable bond market condition or growth economy is the one of important factors to issue the first public bond. **Hale and Santos (2007)** use the recession indicator and the number of bond that issue in the year of bond IPO. The result shows that state of economy and volume of issue bond have negative relation with the decision to issue the initial public bond. On the hand, economy recession and low volume of

issue bond that represent the unfavorable deter firms to issue the public bond. This result is similar to studies on initial public offering of equity. In sum, the state of economy and bond market condition is one of factors to determine the issue public bond other than characteristic of firms.

In this view, previous researches use macro economic such GDP growth, the number of bonds issued in the year of the bond IPO to test market timing to issuing public bond of firms.

III. DATA AND METHODOLOGY

Data

A sample of initial public offering of bond of Thai firms listed on the Stock Exchange of Thailand (SET) during the period of 1997 to 2007 is obtained from the Securities and Exchange Commission (SEC). The sample is then cross-checked with the Thai Bond Market Association (Thai BMA). During the study period, the sample firms that issue bond is 20 firms of the total 380 firms, except for firms in rehabilitation, banking, finance and securities and insurance sector. These firms are ADVANC, AP, BECL, BCP, CK, CPF, CPI, EASTW, GOLD, HMPRO, MK, PTT, RATCH, SCC, SHIN, SPI, THAI, THCOM, TRUE, and VNG.

Table III presents the frequency of announcement of initial public bond issuances by offering year and by length of the time between the initial public offering of stock and bond. The results shown in Panel A disclose a range in the number of offering initial public bond overtime. From the sample year in 1997, 1998 and 2001 have no observation offering initial public bond while have the highest number of 7 in 2002. For panel B, show the length of time between firms issue the initial public of stock and bond. The table show that the time between stock IPO and bond IPO of most sample firms is between 5 year and 10 year.

[Table III is here]

The dependent variable is period before firms issue public bond but after the firms enter to stock market (Survival period), affected through hazard function. The independent variables are obtained from SETSMART and ThaiBMA website that are following;

4.1 Size of Firms

The empirical studies suggest that if firms have more information asymmetry, the firm's faster to access the initial public offering. We use total asset of firms (TA) and sales (SALE) as proxies of firm size.

4.2 Credit Quality of Firms

From the prior papers, such a Dimond (1991) firms with high quality or high credit rating prefer to fund from issuing bond while low quality firms tend to use loan bank since they want to use benefit from effective of bank monitoring. We use debt to asset (DTA), interest coverage ratio (INTC), Altman's Z-score (Z) and return on assets (ROA) as proxies of credit quality of firms

For Altman's Z-score, Edward Altman developed a Z-score model based on five financial ratios. Altman's Z-score calculate is as Z = 1.2 (net working capital divided total assets) + 1.4(retained earnings assets divided total assets) + 3.3(earning before interest and taxes divided total assets) + 0.6(market value of equity divided book value of total liabilities) + 0.999(sales divided total assets). The grater a firm's Z-score, the lower its risk of going bankrupt that imply great credit quality.

4.3 Growth Opportunities

In many studies use Market to book ratio (MTB) as proxy of growth opportunities. MTB measured as the ratio of the book value of asset subtract book value of equity plus the market value of equity divided by the book value of total assets.

4.4 Funding Choice

Some previous papers tell that firms issue the private bond having more probability to enter public bond market. While some researches show that private bond is substitute to public bond financing. So this is delay the decision to enter the public bond. We use the issuing the

private bond (BOND) as proxy of funding choice. Firm's that used to issue private bond, we give the value 0f 1. Conversely, if firm's never issue private bond before, we give the value of 0.

4.5 Bond Condition

We use the number of bond issue at year of initial public bonds (NIPOB) and growth rate of GDP (GDP) as a proxy of bond condition.

Methodology

4.6 Survival Analysis

Survival analysis is the analysis that often used to study problem which associate with duration data or the passage of time before a certain event occurs. The important points of this method are how long the period that event occurs until the end of event and the probability of that event will end in the next period. In our study, the event of interest is the firm's decision to issue the first public bond. However, we often don't observe the event of interest in the entire subject (all firms in Thai stock market for this study). These incomplete observations are said to be censored or truncated. This particular problem makes this type of analysis tricky.

Hazard Function

The hazard function is an important analytic tool for the analysis of survival data. The hazard function is used to describe the probability that the interest of event will occur in the next period, condition on the subject having survived to present.

Consider a subject in the firm's decision to issue first public bond study. We assume T is the period that firms enter into stock market already but do not issue the public bond or survival time. Density function of T is f(t). The cumulative distribution function is the probability that firms have a survival time less than some stated value, t. This denoted as

$$F(t) = \int_0^t f(s)ds = \Pr(T \le t)$$

S is the period between 0 to t

The survival function is the probability of observing a survival time greater than or equal to some stated value t, denoted

$$S(t) = \Pr(T \geq t)$$

If we determine that the probability of event time is at least or equal to 1, we denote that

$$S(t) = 1 - F(t) = \Pr(T \geq t)$$

From the relationship of f(t), F(t) and S(t) , we can find the hazard function that is

$$h(t) = \lim_{dt \to 0} \frac{P(t \leq T \leq t + dt | T \geq t)}{dt}$$

$$h(t) = \lim_{dt \to 0} \frac{F(t + dt) - F(t)}{dS(t)}$$

$$h(t) = \frac{f(t)}{S(t)}$$

There are 3 form of the hazard function to analyze in survival analysis that are

Parametric

This form determines the distribution of data (e.g., normally distributed and logistic distributed). The samples of parametric model for the analysis of survival time data are the exponential, Weibull and Gompertz.

Non-Parametric

This form does not determine the distribution of data or distribution free model. The samples of non-parametric model for the analysis of survival time data are Kaplan-Meier and using the Life Table.

Semi-Parametric

This form has 2 parts. First part does not assume the distribution while the second part is determined the distribution. Cox proportional hazard model that we use in this study is the example of semi-parametric model. Under Cox model, the hazard function is assumed to be

$$h(t, X_i, \beta, h_0) = h_0(t)\exp(X_i \beta)$$

In this setting, $\exp(X_i\beta)$ is defined as exponential distribution while $h_0(t)$ is the baseline hazard that is not defined the distribution.

In this paper, we use Cox proportional hazard model which is part of survival analysis as an analytical tool to find the determinant of the timing of firm's to issue the first public bond. The dependent variable is the period before firms issue the first public bond but after they enter the stock market (survival period). The independent variables are summaries as follow;

- Total Asset
- Sale
- Altman's Z score
- Debt/Asset
- ROA
- Interest Coverage Ratio
- Market to book ratio
- GDP growth
- The number of bond issue at year of initial public bonds

Dummy Variable

- Funding Choice, we use the issuing the private bond of firms as proxy of funding choice.

According to the descriptive statistics in Table IV, it reports all variables comparison across the period. In Panel A of Table IV show the descriptive statistic of all variables in the whole sample period; 1997-2007 while show the descriptive statistic variables in the sub-period in Panel B of Table IV.

[Table IV is here]

The result in Panel B shows that the mean value of LOGTA and LOGSALES in the whole sample period and all sub-period are little different.

The mean value of LOGZ, INTC and ROA as proxies of firms' credit quality and mean value of MTB as proxies of firms' growth opportunity in the sub-period 1997-2000 are 2.04, 443.51 -0.01 and 1.36 respectively and the lowest comparing to other sub-period since firms in Thailand had suffered from financial in this period.

When we look at the market condition of bond market as captured by NIPOB, it is showed that the volume of initial public bond market in sub-period; 2001-2003 are 0.93 and more difference and highest comparing to the other sub-period. It may be derived from the reason that banks do not give the loan even having high liquidity to avoid the NPLs problem.

To test the relationship between the independent variables, we use Spearman rank correlation test.

The Spearman rank correlation coefficient r_s

$$\mathbf{r_s} = 1 - \frac{6\sum \mathbf{d_i^2}}{\mathbf{n(n^2 - 1)}}$$

Where n = the number of items or individuals being ranks

xi = the rank of item i with respect to one variable

yi = the rank of item I with respect to a second variable

di = xi – yi

[Table V is here]

According to Table V, there are high correlated in TA and SALE which indicate size of firms, so we should one of them to being as proxies. Moreover, proxies in firms' credit quality that are Z, ROA, DTA and INTC also rather high correlated, so we should one of them to being an indicator.

4.7 Cox Proportional Hazard Model

The hazard function is the product of two functions that is

$$\mathbf{h(t, x, \beta)} = \mathbf{h_0(t) r(x, \beta)}$$

Where ; t is the period that we study (Survival Time)

; x is the independent variables and a dummy variable

; β is coefficient of x

With this model, $h(t,x,\beta)$ is the hazard function at time t and $h_0(t)$ is baseline hazard or hazard for an individual when the value of all the independent variables equal zero that have a function of survival time while $r(x,\beta)$ have the function of covariate

Under this model, the ratio of the hazard functions for two subjects with differing covariate value is

$$\begin{aligned}\mathbf{HR}(\mathbf{t},\mathbf{x}_1,\mathbf{x}_0) &= \frac{\mathbf{h}(\mathbf{t},\mathbf{x}_1,\boldsymbol{\beta})}{\mathbf{h}(\mathbf{t},\mathbf{x}_0,\boldsymbol{\beta})} \\ &= \frac{\mathbf{h}_0(\mathbf{t})\mathbf{r}(\mathbf{x}_1,\boldsymbol{\beta})}{\mathbf{h}_0(\mathbf{t})\mathbf{r}(\mathbf{x}_0,\boldsymbol{\beta})} \\ &= \frac{\mathbf{r}(\mathbf{x}_1,\boldsymbol{\beta})}{\mathbf{r}(\mathbf{x}_0,\boldsymbol{\beta})}\end{aligned}$$

This ratio indicates the expected change in the risk of the terminal event when x changes from 0 to 1

Cox (1972) was the first to propose the model that specified only r(x,β), which is exp(x,β) while baseline hazard of time t is not based on any assumptions concerning the nature or survival distribution. Thus, Cox proportional hazard model is considered as semi-parametric method and hazard function including the hazard ratio are as following (respectively);

$$\mathbf{h}(\mathbf{t},\mathbf{x},\boldsymbol{\beta}) = \mathbf{h}_0(\mathbf{t})\mathbf{e}^{\mathbf{x}'\boldsymbol{\beta}}$$

$$\mathbf{HR}(\mathbf{t},\mathbf{x}_1,\mathbf{x}_2) = \mathbf{e}^{\boldsymbol{\beta}(\mathbf{x}_1-\mathbf{x}_0)}$$

In this setting, a positive coefficient indicates that an increase in the independent variables shortens the time until firms issue their first public bond.

4.8 Testing the Proportional Hazard Assumption

After we get the value of β from the estimation, we would test the model's goodness of fit since the important assumption of the cox proportional hazard model require that hazard ratio from comparing two specifications must be constant when time varying.

Test of proportional hazard assumption can explain from this equation;

$HR(t, X_1, X_0) = \frac{r(X_1,\beta)}{r(X_0,\beta)} = \hat{\theta}$, $\hat{\theta}$ must be constant, invariant to time (t)

In addition, we test model's goodness of fit from p-value (calculation from Chi-square comparing each variable to other variables) at 95% confidence level. If p-value greater than 0.05, we accept the null hypothesis that model has the proportional hazard function.

4.9 How to predict and evaluate the model

Under hazard model, prediction is done by compute the survival probability, $S(t|X_i,\beta)$ of each firm and compare to them to cut-off value. If $S(t|X_i,\beta)$ greater than cut-off value, it means that those firms tend to issue public debt, otherwise.

We can calculate the $S(t|X_i,\beta)$ from

$$S(t|X_i,\beta) = S_0(t)^q$$
$$q = \exp(X_i\beta) \text{ and}$$
$$S_0(t) = \exp\left[-\int_0^t h_0(u)du\right]$$

In addition, we test the accuracy of model's prediction compare to actual event to compute Counted R^2

$$Counted\ R^2 = \frac{correction\ prediction}{Total\ sample\ observation}$$

The higher counted R^2 imply that the more accuracy in model's prediction.

IV. EMPIRICAL RESULT

5.1 Result from estimation the Cox Proportional Hazards Model

The objective of this study is to investigate the determinant of firm's decision to issue IPO bond. So we separate sample firms into two types; firm's that issue public bond already and firm never issue bond to public.

Main equation to estimate the Cox Proportional Hazard model is

$$\mathbf{LLF} = \sum_{\mathbf{i}=1}^{\mathbf{n}} \left\{ \mathbf{d_i X_i \beta} - \ln\left[\sum_{\mathbf{k} \in \mathbf{R}_{(i)}} \exp(\mathbf{X_k \beta}) \right] \right\} \mathbf{X}$$

where ; x is the independent variables

; d_i is dummy variable that show experienced of private bond

; β is a coefficients of x

; LLF is a probability that firm's issue the IPO bond

According to the equation above, if any independent variables have positive sign, show that they speed up firms to issue initial bond to public. Conversely, if any independent variables have negative coefficient show that they deter firms to issue initial public bond.

From Table V that there are high correlated in proxies of firm size (LOGTA and LOGSALE) as well as proxies in credit quality of firms (LOGZ, INTC, ROA and DTA). Thus, we select LOGTA and LOGZ to represent the variable for firm size and firm's credit quality, respectively. Since most previous studies often use the total asset as proxy of firm's size and Alman's Z-score is combination of several financial ratio both profitability side and debt side. So we estimate the equation above with six variables; LOGTA, LOGZ, BOND, NIPOB, GDP and MTB. After estimate the Cox Proportional Hazards model with Partial likelihood method in STATA program, we get the result as shown in Table VI;

[Table VI is here]

Panel A of Table VI report the estimation for the whole study period. In the third column show that LOGTA, BOND and NIPOB can explain the decision to issue the public bond during 1997 to 2007 in positive sign at 0.05 significant level. The result confirms that

firm size (using the LOGTA as proxies) and experienced from issuing the private bond (BOND) has positive relation with the probability to issue the first public bond. The larger firms and private bond issuances have more probability to issue the first public bond than firms did not issue a private bond first. This result from lower information asymmetry between investors and issuers in larger firms and private bond issuances reduce the adverse selection problem and give the confidence to investors to buy the public bond of these firms. In addition, the larger firms tent to have more issue size get advantage from the economies of scale from issuing the public bond than the smaller firms following the flotation cost hypothesis. For NIPOB, the result show that the more in NIPOB, the more probability to issue the public bond. The more in NIPOB or the more in volume of initial public offering bond indicates the good market timing in bond market and is appropriate time to issue the public bond.

As we mention in descriptive statistic, the value of variables is rather differ for each period during 1997 to 2007 due to the affect of financial crisis in 1997. We split the entire study period (1997 to 2007) into sub-periods; 1997-2000, 2001-2003, 2004-2007 and 2001 to 2007 as showing in Panel B of Table VI.

Panel B of Table VI show that LOGTA is significant variable at 0.05 level in all sub-period even in the crisis period. It means that the larger firms tend to issue the first public bond faster than the small firms following from information asymmetry and floatation cost hypothesis. BOND and GDP are significant variable at 0.05 level in all period, except in the crisis period. BOND and probability to issuing public bond has positive relation, which is similar to result testing in the whole period and consistent with the information asymmetry hypothesis. Thus, the more in LOGTA and BOND, make the more probability to issue the public bond. While the relationship between the probability of issue the public bond and proxies of market timing as NIPOB and GDP is not consistent in each sub-period. Some periods GDP and NIPOB have positive relation with issuing the public bond, some periods GDP and NIPOB have negative relation. Due to GDP and NIPOB in each sub-period has more different and volatility. In addition, the less observation after we split into sub-period is the another factor make the inconsistent in relation. However, if we focus on the result of NIPOB

in studied the whole period and sub-period in 2001-2007, we found that NIPOB has positive relation with the probability to issue the public bond. This is consistent with the market timing hypothesis in that good market environment captured by the volume of issuing bond support firms to issue the public bond.

5.2 Test of Proportional Hazards Assumption

After we get β from the estimation, we test the model's goodness of fit. Since the Cox proportional Hazard has an important assumption call "Proportional Hazards", meaning hazard ratio obtained from comparing two specifications must be constant when time is varying.

[Table VII is here]

The models that study in whole period and sub-period, except studying in 1997 to 2000, accept the null hypothesis that the effect of independent variables in the model would not change when time varying, therefore, our model coincides to the major assumption of the Cox Proportional Hazard model. While the estimation in sub-period, 1997 to 2000, the P-value (calculating from Chi-square comparing each variable to other variables in the model) is lower than 0.05, we reject null hypothesis that model has the Proportional Hazard Assumption. It means that the coefficient or β from the estimation change when time change. Thus, we can not use the estimation that studied in 1997 to 2000.

5.3 Prediction and Model Accuracy

After we get β from the estimation, we also find the baseline hazard and baseline survival from STATA. Next, we calculate the predicted survival and compare them to the cut off value.

Predicted survivorship function is

$$S(t,x,\beta)=[S_0(t)]^{\exp(x\beta)}$$

where ; t is the period that we study

; x is the independent variables and a dummy variable

; β is coefficients of x

Our cut off value is 0.05 as there were 20 issued public bond firms from all 380 firms (20/380) during our study period. If any firms has the predicted survival lower than 0.05, they tend to issue bond to public. Conversely, if any firms have predicted survival greater than 0.05, they still not to issue public bond.

Then to test the accuracy of this prediction model, we compare the predicted issuing the first public bond, obtained from comparing predicted survival and cut off value, and the actual situation for each observation. If the model can predict accurate with actual, it is the correct forecast.

According to testing the accuracy of model prediction, we found that model that study in sub-period; 2004 to 2007 gives the best accuracy prediction. It has the wrong prediction 162 observations; hence the overall accuracy is 98.75%. This error can explain by type I 0.15% and 1.10% in type II. While the model that study in sub-period; 2001 to 2003 give the lowest accuracy prediction. It has the wrong prediction 1,799 observations, thus the overall accuracy is 86.11%. This error comes from type I 0.05% and type II 13.85%. The type II error in sub-period 2001-2003 comes from bank in Thailand limit loan during this period to avoid NPLs problem so firms finance fund from other source or from the internal. This makes the financial ratio and NIPOB have more volatility and make more error in this model.

However, the model both in the whole sample period and the sub-period provide high accuracy, we can say that Cox Proportional Hazard Model can predict the decision to issue the first public bond.

V. CONCLUSION

This study investigate the determinants of timing decision to issue the first public bond for the sample of 380 firms in the Stock Exchange of Thailand (SET), excluding firms in rehabilitation, banking, finance and securities and insurance sector, during 1997-2007 by using the Cox Proportional Hazard model. During 1997 to 2000, most firms suffered from financial crisis since 1997. Then, the economy in 2001 to 2003 begins to pick up, thus some

firms started to recover. As a result, this study tests the determinant of timing decision to issue the initial public offering in period of 1997 to 2007 and four sub-periods; 1997-2000, 2001-2003, 2004-2007 and 2001-2007. The finding indicates the significant variables that determine the decision of Thai firms in the whole period and sub-period are LOGTA and BOND which are the proxy variables that capture the information asymmetry and flotation cost. Follow the information asymmetry hypothesis, larger size firms and experience issuing private bond firms tend to issue the public bond faster than the smaller firms. Under the information asymmetry hypothesis, investors have almost equally information on large size firms and private bond issuances as the issuers do. The adverse selection problem of investors is low. Then, investors have more confident to buy public bond from larger size firms and private bond issuances than those of smaller firms and firms with no experience in issuing private bond before. Therefore, large firms and experienced private bond firms are mostly successful in issuing the public bond. As a result, large firms and firms with experience issuing private bond are more likely to issue the public bond faster than small firms. In addition, under the flotation cost hypothesis and the fact that cost of issuing the public bond is higher than that of private, the large size firms gain their cost advantage from the economies of scale. Accordingly, larger size firms issue more public bond.

Concerning on market timing hypothesis, the proxy variables, NIPOB and GDP, do not show significant impact on the decision to issue the initial public bond in all sub-period analyses. The results cannot be concluded that both variables have less influence on the decision to issue the public bond market in Thai firms. Therefore, this study does not find the evidence market timing hypothesis.

Concerning on accuracy of the models, results from whole sample period analysis and sub-period analysis mostly provide accurate prediction only sub-period in 2001-2003 that have large type II error. This inaccuracy prediction might come from the limiting loan of the bank and financial institutions in Thailand during this sub-period in order to avoid NPLs problem, thus, firms tend to finance themselves internally. Financial ratio and NIPOB were more volatile which in turn cause high prediction error during this sub-period analysis.

In summary, the results support the information asymmetry and flotation cost hypotheses. The large size firms and firms with experience in issuing private bond tend to issue the public bond faster than the smaller firms. However, this study does not find the evidence that support the market timing hypothesis.

References

Anderson, C. W. and A.K. Makhija, 1999, Deregulation, disintermediation, and agency costs of debt: evidence from Japan, *Journal of Financial Economics* 51, pp. 309-339.

Arikawa, Yasuhiro, 2008, The Choice between Public and Private Debt by Japanese Firms, *Journal of International Economic Studies* (2008), No.22, 19–30

Barclay, Michael J., and Clifford W. Smith, 1995a, The maturity structure of corporate debt, *Journal of Finance* 50, 609-632.

Berlin, Mitchell and Jan Loeys, 1988, Bond covenants and delegated monitoring, *Journal of Finance* 43, 397-412.

Blackwell D.W. and D.S. Kidwell, 1988, An investigation of cost differences between public sales and private placements of debt, *Journal of Financial Economics* 22, 253-278.

Cantillo, M., Wright, J., 2000, How do firms choose their lenders? An empirical investigation, *Review of Financial Studies* 13, 155-189.

Denis and Mihov., The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings, *Journal of Financial Economics* 70(2003) 3-28.

Diamond, D.W., 1991, Monitoring and reputation: The choice between bank loans and directly placed debt, *Journal of Political Economy* 99 (4), 689-721.

Easterwood J.C. and P. Kadapakkam, 1991, The Role of private and public debt in corporate capital structures, Financial Management 20, 49-57.

Fama, Eugene, 1985, What's different about banks?, *Journal of Monetary Economics* 15, 29-37.

Hale and Santos., 2007, The decision to first enter the public bond market: The role of firm reputation, funding choices, and bank relationships, *Journal of Banking & Finance*, Volume 32, Issue 9, 1928-1940

Hori, K. and H. Osano, 2002, Financial relations between banks and firms: new evidence from Japanese data, Kyoto Institute of Economic Research, Discussion Paper No. 546.

Hoshi,T., Kashyap, A., and D. Scharfstein, 1993, The choice between public and private debt: an analysis of post deregulation corporate financing in Japan, *NBER Working Paper* 4421.

Johnson, Shane, 1997, An empirical analysis of the determinants of corporate debt ownership structure, *Journal of Finance and Quantitative Analysis* 32, 47-69.

Krishnaswami, Sudha, Paul A. Spindt, and Venkat Subramaniam, 1999, Information asymmetry, monitoring and the placement structure of corporate debt, *Journal of Financial Economics* 51, 407-434.

Myers, Stewart, 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147-175.

Rajan, R.G., 1992, Insiders and outsiders: The choice between informed and arm's length debt, *Journal of Finance* 47(4), 1367-1400.

Shirasu, Y.A. and P. Xu, 2007, The Choice of financing with public debt versus private debt: new evidence from Japan after critical binding regulations were removed, *Japan and World Economy*, 19, pp. 393-424.

Udomchok, Nop, 2005, Private placement of securities issue: some empirical evidences in Thailand, Independent Study, Thammasat University.

Table I

Size of the Financial & Capital Markets in Thailand

This table quantified the value of bank loans, equity market and bond market in Thailand during year 2004 to 2007. It shows that the value of the bond market is around 70% of the equity market value and 77% of the bank loans value in 2007.

Unit: Billion Bath

Market	2004	2005	2006	%change	2007	%change
Bank loans*	5,237.54	5,681.45	5,892.82	3.72	6,042.28	2.54
Equity Market* (Market Cap)	4,521.89	5,105.11	5,078.80	(0.52)	6,636.07	30.66
Bond Market** (Par)	2,402.26	3,122.74	3,951.31	26.53	4,698.88	18.92
Total	12,161.69	13,909.30	14,922.93	7.29	17,377.23	16.45

Source: * Bank of Thailand (BOT)
** ThaiBMA

Table II

New Debt Securities Issuances

This table quantified the value of bond market in Thailand for each type of bond during year 2004 to 2007. This table shows that in the primary bond market in 2007, the issued size of new corporate bonds totaled Baht 1,170.51 billion. Thus, the Thai corporate bond market is growing to the important source of fund for companies even magnitude of market is still small compared to other markets.

Unit: Billion Bath

Market	2005	2006	%change	2007	%change
Government Bond	188.90	220.70	16.83	330.22	49.62
T-Bills	494.00	897.20	81.62	553.00	-38.36
State Own Enterprise Bond	99.44	69.73	-29.88	94.83	36.00
State Agency Bond	988.28	1,001.60	1.35	4,121.55	311.50
Corporate Bond	179.38	881.24	391.27	1,170.51	32.83
Foreign Bond	7.00	9.10	30.00	9.77	7.36
Total	1,957.00	3,079.57	57.36	6,279.88	103.92

Source: *ThaiBMA

Table III

Frequency Announcement of Initial Public Bond Issuances by Offering Year and Time between the Stock IPO and Bond IPO

This table presents the frequency of announcement of initial public bond issuances by offering year and by length of the time between the initial public offering of stock and bond. The results shown in Panel A disclose a range in the number of offering initial public bond overtime. From the sample year in 1997, 1998 and 2001 have no observation offering initial public bond while have the highest number of 7 in 2002. For panel B, show the length of time between firms issue the initial public of stock and bond. The result show that the time between stock IPO and bond IPO of most sample firms is between 5 year and 10 year.

Panel A: Frequency Announcement of Initial Public Bond Issuances by Offering Year		
Year	Frequency	Percentage
1997	0	0.00
1998	0	0.00
1999	1	5.00
2000	2	10.00
2001	0	0.00
2002	7	35.00
2003	3	15.00
2004	4	20.00
2005	2	10.00
2006	0	0.00
2007	1	5.00
Total	20	100.00
Panel B: Time between the stock IPO and the bond IPO		
Descriptive Variables	Frequency	Percentage
Lag ≤ 1 year	0	0.00
1<lag ≤ 5	2	10.00
5<lag ≤ 10	10	50.00
10<lag ≤ 15	5	25.00
15<lag ≤ 20	1	5.00
20<lag	2	10.00

Table IV

Descriptive Statistics

This table summaries statistic of the total variables in the model by separate in 5 periods; 1997 to 2000, 2001 to 2003, 2004 to 2007, 2001 to 2007 and 1997 to 2007. LOGTA is the log of total assets. LOGSALE is the log of sales. INTC is the interest coverage ratio measured by EBITDA (earnings before interest, taxes, depreciation, and amortization) to interest expense. LOGZ is the log of Altman's Z-score which measure by 1.2 (net working capital assets divided total assets) + 1.4(retained earnings assets divided total assets) + 3.3(earning before interest and taxes divided total assets) + 0.6(market value of equity divided book value of total liabilities) + 0.999(sales divided total assets). ROA is EBITDA over the total assets. DTA is total debt divide by total assets. BOND is dummy variable by giving the value of 1 to firm used to issue private bond. Conversely, give the value of 0 to firms never issue public bond. NIPOB is the number of firms that issue the public bond market in each quarter. GDP is the growth rate of gross domestic product. The MTB is the market to book value of firms.

Year	Variables	Mean	Median	Std. Dev.	Min	Max	Obs.
Panel A: Whole Sample Period: 1997 to 2000							
	LOGTA	6.47	6.38	0.60	0.00	8.96	12,949
	LOGSALE	5.68	5.673678	0.68	2.36	8.64	12,731
	LOGZ	2.31	2.39	0.56	-3.82	3.97	12,900
	INTC	1,067	3.71	19,400	-20,4373	1,266,894	12,108
	ROA	0.03	0.02	0.51	-10.65	47.45	12,931
	DTA	0.59	0.51	1.23	0.00	62.05	12,941
	BOND	0.17	0.00	0.38	0.00	1.00	12,949
	NIPOB	0.47	0.00	0.75	0.00	3.00	12,949
	GDP	3.31	4.7	4.82	-13.90	8.40	12,949
	MTB	1.61	0.92	6.87	0.00	513.96	12,110
Panel B: Sub Sample Period							
1997-2000	**LOGTA**	6.45	6.38	0.58	5.24	8.54	4,119
	LOGSALE	5.54	5.530718	0.65	2.49	7.56	4,057
	LOGZ	2.04	2.11	0.56	-1.26	3.60	4,103
	INTC	443.51	1.44	10271	-161682	517,082	3,884
	ROA	-0.01	0.01	0.29	-10.65	5.88	4,113
	DTA	0.66	0.61	0.76	0.00	35.18	4,113
	BOND	0.18	0.00	0.38	0.00	1.00	4,119
	NIPOB	0.19	0.00	0.53	0.00	2.00	4,119
	GDP	-0.60	1.00	6.77	-13.90	8.40	4,119
	MTB	1.36	0.62	6.98	0.00	272.71	3,732
2001-2003	**LOGTA**	6.43	6.34	0.61	4.71	8.51	3,237
	LOGSALE	5.64	5.669855	0.69	2.36	8.10	3,176
	LOGZ	2.31	2.38	0.56	-3.82	3.71	3,220
	INTC	930.15	4.57	10391	-91548	316407.00	3,035
	ROA	0.06	0.03	0.89	-1.62	47.45	3,231
	DTA	0.69	0.5	1.78	0.00	42.29	3,237
	BOND	0.19	0.00	0.39	0.00	1.00	3,237
	NIPOB	0.93	1.00	0.96	0.00	3.00	3,237
	GDP	4.93	5.8	2.13	1.70	8.30	3,237
	MTB	1.66	0.95	5.52	0.00	223.38	2,917

Year	Variables	Mean	Median	Std. Dev.	Min	Max	Obs.
Panel B: Sub Sample Period							
2004-2007	**LOGTA**	6.51	6.4	0.62	0.00	8.96	5,593
	LOGSALE	5.79	5.769592	0.68	2.63	8.64	5,498
	LOGZ	2.50	2.55	0.48	-1.56	3.97	5,577
	INTC	1614	6.04	27,122	-204373	1,266,894	5,189
	ROA	0.05	0.03	0.27	-1.60	8.71	5,587
	DTA	0.49	0.45	1.09	0.01	62.05	5,591
	BOND	0.16	0.00	0.37	0.00	1.00	5,593
	NIPOB	0.42	0.00	0.60	0.00	2.00	5,593
	GDP	5.26	5.10	0.87	3.60	6.70	5,593
	MTB	1.76	1.13	7.43	0.00	513.96	5,461
2001-2007	**LOGTA**	6.48	6.38	0.62	0.00	8.96	8,830
	LOGSALE	5.74	5.735946	0.69	2.36	8.64	8,674
	LOGZ	2.43	2.5	0.52	-3.82	3.97	8,797
	INTC	1361.60	5.48	22451	-204373	1,266,894	8,224
	ROA	0.05	0.03	0.58	-1.62	47.45	8,818
	DTA	0.56	0.47	1.39	0.00	62.05	8,828
	BOND	0.17	0.00	0.38	0.00	1.00	8,830
	NIPOB	0.61	0.00	0.79	0.00	3.00	8,830
	GDP	5.14	5.1	1.47	1.70	8.30	8,830
	MTB	1.73	1.05	6.82	0.00	513.96	8,378

Table V

Spearman's Rank Correlation Test

Spearman's rank correlation coefficient is a non-parametric measure of correlation- that is, it assesses how well an arbitrary monotonic function could describe the relation between two variables, without making any assumptions about the frequency distribution of the variables.

According to results, we can conclude that there are high correlated in TA and SALE which indicate size of firms, so we should one of them to being as proxy. Moreover, proxies in firms' credit qualities that are Z, ROA, DTA and INTC also rather high correlated, so we should one of them to being an indicator.

Variables	LOGTA	LOGSALE	LOGZ	ROA	DTA	INTC	BOND	NIPOB	GDP	MTB
LOGTA	1.0000									
LOGSALE	0.7744	1.0000								
LOGZ	0.0389	0.1931	1.0000							
ROA	0.0691	0.2546	0.4903	1.0000						
DTA	0.2814	0.1732	-0.4795	-0.3554	1.0000					
INTC	-0.0053	0.1963	0.5208	0.6560	-0.5141	1.0000				
BOND	0.5045	0.3948	0.0629	0.0723	0.1673	-0.0062	1.0000			
NIPOB	-0.0060	0.0431	0.1356	0.1442	-0.0506	0.1250	0.0196	1.0000		
GDP	0.0196	0.0957	0.2938	0.1262	-0.1147	0.1789	0.0137	0.4111	1.0000	
MTB	0.2155	0.3325	0.7620	0.3515	0.0757	0.2819	0.1781	0.1407	0.2730	1.0000

Table VI

The Model Estimated from the Cox Proportional Hazards Model

From the model estimation, if any independent variables have positive sign, show the increasing probability that firms issue the initial bond to public. Conversely, if any independent variables have negative coefficient, it shows the opposite result. In the third column of Panel A, there are 4 significant variables at 0.05 confidence level; log of total asset (LOGTA), interest coverage ratio (INTC), experienced from issuing the private bond (BOND) and the volume of initial public bond (NIPOB). However, there are high correlated between log of total asset and log of sales so we choose the log of total asset as proxy of firm's size. Same as the proxies in the credit quality of firms that rather high correlated, we choose the log of Altman'z Score to the represent proxy of this group. In the fourth column of Panel A, show the estimation with the selected variables and find that there are 3 significant variables at 0.05 confidence level; LOGTA, BOND and NIPOB. In the Panel B, we split the entire study period (1997-2007) into sub-period; 1997-200, 2001-2003, 2004-2007 and 2001-2007 and found that LOGTA is significant variable at 0.05 level in all sub-period and consistent with our expected sign. While BOND and GDP are significant variables at 0.05 level in all period, except in the sub-period 1997-2000. NIPOB are significant variables at 0.05 level in sub-period 1997-2000 and 2001-2007. BOND provides the coefficient sign as we expected in all sub-period while the coefficient sign of NIPOB and GDP are different from our expectation in some period and some period correct to our expected sign.

Panel A : Whole Sample Period : 1997 to 20007

Variables	Expected Sign	Coefficient	Coefficient
LOGTA	+	1.577**	1.220**
LOGSALE	+	-0.450	
LOGZ	+	1.505	0.949
INTC	+	-0.000**	
ROA	+	-1.618	
DTA	+	1.206	
BOND	+	2.699**	2.771**
NIPOB	+	1.657**	1.599**
GDP	+	0.560	0.279
MTB	-	-0.082	-0.023
Log likelihood		-78.616	-80.311
Global test		13.890	11.020
Counted R^2		85.37%	91.75%

Panel B : Sub Sample Period

		1997 to 2000	20001 to 20003	20004 to 20007	2001 to 2007
	Expected Sign	Coefficient	Coefficient	Coefficient	Coefficient
LOGTA	+	1.913**	1.514**	1.265**	1.266**
LOGZ	+	2.309	1.323	0.586	0.933
BOND	+	0.307	1.794**	2.782**	2.752**
NIPOB	+	-37.333**	1.119	-0.603	1.713**
GDP	+	0.070	-5.014**	2.233**	-0.462**
MTB	-	-0.023	-0.018	0.0382	-0.034
Log likelihood		-11.048	-52.102	-82.019	-80.444
Global test		0.003**	3.810	0.530	8.190
Counted R2		-	86.11%	98.75%	96.18%

** Significant at the 0.05 confidence level.

Table VII

Test of Proportional Hazards Assumption

The Cox Proportional Hazards model has an important assumption, call "Proportional Hazards", meaning Hazard ratio obtained from comparing two specifications must be constant when time is varying. Test of Proportional Hazard Assumption can explain from this equation;

$$HR(t, X_1, X_0) = \frac{r(X_1, \beta)}{r(X_0, \beta)} = \hat{\theta}, \hat{\theta} \text{ must be constant, invariant to time (t)}$$

Goodness of fit can be reflected on P-value (calculating from Chi-square comparing each variable to other variables in the model) at the 0.05 confidence level. If P-value is greater than 0.05, we accept the null hypothesis that model has the Proportional Hazard Assumption.

This table shows the result from testing the Proportional Hazard Assumption test; all testing both in the whole sample period and the all sub-period, except testing in sub-period 1997-2000, are insignificant at 0.05 level (as seeing in the p-value of global test), so we accept the null hypothesis that our model has the Proportional Hazard Assumption or the coefficient of independent variables do not change when time vary.

Panel A : Whole Sample Period : 1997 to 20007

	Variables	Rho	chi2	df	Prob>chi2
	LOGTA	-0.0045	0.0000	1	0.9804
	LOGSALE	0.0522	0.0800	1	0.7773
	LOGZ	-0.2959	5.6700	1	0.0172
	ROA	-0.2757	4.5700	1	0.0326
	DTA	-0.1719	1.6000	1	0.2054
	INTC	-0.3753	2.7900	1	0.0946
	BOND	0.4279	10.3000	1	0.0013
	NIPOB	0.1995	0.4100	1	0.5220
	GDP	0.4492	3.9600	1	0.0466
	MTB	0.1648	0.7700	1	0.3788
	Global Test		**13.8900**	**10**	**0.1779**

Panel B : Sub Sample Period :

	Variables	Rho	chi2	df	Prob>chi2
1997-2000	**LOGTA**	-0.89052	13.90	1	0.0002
	LOGZ	-0.82079	10.93	1	0.0009
	BOND	0.94734	19.34	1	0.0000
	NIPOB	0.92890	7.16	1	0.0074
	GDP	-0.94597	191.19	1	0.0000
	MTB	0.91749	11.86	1	0.0006
	Global Test		**19.94**		**0.0028****
2001-2003	**LOGTA**	0.06063	0.04	1	0.8493
	LOGZ	-0.27054	1.55	1	0.2127
	BOND	0.28123	1.67	1	0.1959
	NIPOB	-0.05017	0.01	1	0.9303
	GDP	0.03214	0.00	1	0.9587
	MTB	-0.07434	0.02	1	0.8949
	Global Test		**3.81**	**6**	**0.7028**

	Variables	Rho	chi2	df	Prob>chi2
2004-2007	**LOGTA**	-0.15575	0.31	1	0.5771
	LOGZ	-0.0565	0.01	1	0.9249
	BOND	-0.00970	0.00	1	0.9621
	NIPOB	0.04721	0.00	1	0.9536
	GDP	-0.16422	0.12	1	0.7302
	MTB	**-0.08059**	**0.03**	**1**	**0.8651**
	Global Test		**0.53**	**6**	**0.9974**
2001-2007	**LOGTA**	-0.04268	0.02	1	0.8885
	LOGZ	-0.46395	3.17	1	0.0750
	BOND	0.47022	6.28	1	0.0122
	NIPOB	-0.19745	0.07	1	0.7880
	GDP	0.48801	1.98	1	0.1559
	MTB	-0.23529	0.38	1	0.5401
	Global Test		**8.19**	**6**	**0.2245**

** Significant at the 0.05 confidence level.