Day-of-the-Week Effects in Thailand's Corporate-Bond Market

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Abstract

This study tests for day-of-the-week effects in Thailand's corporate-bond market, using the Thai Bond Market Association's corporate-bond, zero-rate-return indexes of fixed durations and ratings. It is the first study for the market. More importantly, it is able to resolve changing-characteristics problems of bond returns in previous studies. During the sample period from Friday, June 15, 2007 to Friday, March 18, 2016 (2,142 observations), all the sample bonds show high, positive Friday returns; but the day-of-the-week effects are significant for some bonds. I empirically test for alternative explanation and successfully identify the one explanation for the significant effects. I also empirically show that if researchers did not treated the changing characteristics of bond returns appropriately, they could have concluded incorrectly that effects did not exist in Thailand's corporate-bond market.

Keywords: *corporate bonds, day-of-the-week effects, price patterns*

Introduction

Investors consider fixed-income securities as being one of the most important asset classes. If day-of-the-week (DoW) effects–the patterns of returns being high or low on certain weekdays, are identified and the patterns continue, the information will help them to choose the best days of the week to trade their securities (Alexander & Ferri, 2000). DoW effects have been studied for fixed-income securities in national markets around the world. For example for the U.S.A. market, Gibbons and Hess (1981) found low, negative Monday returns and high, positive Wednesday returns on treasury bills, while Flannery and Protopapadakis (1988) found low, negative Monday returns on treasury bonds. However, Jordan and Jordan (1991) could not find the effects for corporate bonds when returns were measured by the Dow-Jones Composite-Bond-Average-index-portfolio returns. Compton and Kunkel (2000) examined DoW effects for managed funds which invested in both corporate and treasury bonds. The researchers found that the funds' returns were positive and highest on Monday and Tuesday. Alexander and Ferri (2000) studied DoW effects in high-yield bonds using the prices of 60 high-yield bonds trading on the Nasdaq and found high, positive Tuesday returns and low, negative Friday returns. Nippani and Pennathur (2004) found the changes of yields on commercial papers were significantly negative on Wednesday. In contrast to Jordan and Jordan (1991), Nippani and Arize (2008), who used three major corporate-bond indexes for the more recent 1982-2002 sample period, reported significant, negative Monday returns on U.S.A. corporate bonds.

Outside the U.S.A., Bildik (2001) found for the Turkish market that overnight interest rates fell on Wednesday and rose on Friday. Keef and Roush (2004) could not find the effects for bank-bill interest rates in the New Zealand market. For the Canadian market, Washer, Nippani and Wingender (2011) found negative Monday returns for commercial papers and treasury bills but not for bank accounts in the 1980's. The effects disappeared in 1990's and re-appeared in the 2000's. Compton, Kunkel, and Kuhlemeyer (2013) studied the Russian market and found Dow effects for corporate bonds whose returns were highest on Friday and lowest on Tuesday. In a study of emerging-market returns, Bespalko (2009) found Dow effects for government bonds in Mexico, the Philippines, Russia, Turkey, and Ukraine, but not in Brazil and Bulgaria. Recently, Khanthavit (2016) studied Thailand's government-securities

markets and reported high Monday returns on treasury bills and high Thursday and Friday returns on treasury bonds.

In this study, I examine DoW effects in Thailand's corporate-bond market. I have two primary motivations. Firstly, Thailand is one of the most important emerging markets in the world. In 2015, its market capitalization of government securities was 282.50 billion U.S. dollars at a 35.50-baht-per-U.S.-dollar exchange rate. In the sample countries of the *Asia Bond Monitor* (Asian Development Bank, 2015), in the third quarter of 2015 Thailand ranked fourth in terms of market capitalization after Japan, China, and Korea. Thailand's corporate-bond market has been growing together with the government-bond market. Based on the Thai Bond Market Association (Thai BMA) data, in the second quarter of 2007 the corporate-bond market capitalization was 26.77 billion U.S. dollars; it was 61.63 billion U.S. dollars in the first quarter of 2016–an average annual growth rate of 9.53 percent. Although Thailand's corporate-bond market has gained its importance in terms of market size and growth at national and regional levels, the study of DoW effects for the market has never been conducted.

Secondly, in previous studies the sample returns were on corporate-bond-composite-index portfolios (e.g. Jordan & Jordan, 1991; Nippani & Arize, 2008) or on mixed-bond portfolios (e.g. Alexander & Ferri, 2000). It is important to note that levels and movements of corporate-bond returns are duration- and credit-dependent. Because durations and credits of the sample portfolios in the previous studies are not fixed due to their compositions at times, the characteristics of the sample-bond returns necessarily change (Flannery & Protopapadakis, 1988). Therefore, it is not clear whether the DoW effects in, for example, Nippani and Arize (2008) were driven by the returns on which duration or credit subgroups in the sample portfolios. And, it is possible that DoW effects might exist but the inability to detect them, for example, in Jordan and Jordan (1991) was caused by the dominance of only some subgroups that did not possess DoW-return patterns. The study of Thailand's corporate-bond market offers me with the opportunity to address these important problems. For Thailand's corporate bonds, daily the Thai BMA computes and reports Zero-Rate-Return (ZRR) indexes of 1- to 5-year durations and AAA- to BBB-credit ratings. In the analysis, I will use the returns on these ZRR-index portfolios, hence enabling me to fix the characteristics of the sample bonds.

Methodology

I follow Gibbons and Hess (1981) to use the classical, linear regression model in Equation (1) for the analysis.

$$r_t = \delta_{Mo} D_{Mo,t} + \delta_{Tu} D_{Tu,t} + \cdots + \delta_{Fr} D_{Fr,t} + \varepsilon_t, \quad (1)$$

where r_t is the daily return on day t. $D_{d,t}$ is a dummy variable. It is 1.00 if day t falls on day d of the week. Otherwise, it is 0.00. Day $d = Mo$ (Monday), …, Fri (Friday). ε_t is the regression error. The estimation is performed by the ordinary-least-square (OLS) technique. Because ε_t may be autocorrelated or heteroskedastic (Kamath , Chakornpipat & Chatrath, 1998), the standard errors of the coefficients δ_d and the hypothesis tests are based on White's (1980) heteroskdasticity-consistent covariance matrix.

The null hypothesis of equal average returns for the five weekdays implies $\delta_{Mo} = \cdots = \delta_{Fr}$. It will be tested by a Wald test. Under the null hypothesis, the Wald statistic is distributed as a chi-square variable with four degrees of freedom. I will conclude that DoW effects exist if the hypothesis is rejected.

Data

The data are daily corporate-bond ZRR indexes of 2-year, 3-year, and 4-year durations and of AAA-credit, AA-credit, A-credit, and BBB-credit ratings from Friday, June 15, 2007 to Friday, March 18, 2016 (2,142 observations). The indexes are constructed and made available to me by the Thai BMA. Although the Thai BMA also constructs the 1-year and 5-year indexes, I limit the analysis to the 2-year to 4-year indexes. Within the sample period, the average duration of corporate bonds is 3.28 years, while the maximum and minimum durations are 3.75 and 2.79 years, respectively. Hence, the 2-year to 4-year samples should suffice for the analysis.

Because the ZRR indexes compound bond returns realized during calendar days from one trading day to the next, the returns I compute are logged-index differences scaled by the number of calendar days between the two trading days. The descriptive statistics of bond returns are reported in Table 1.

From Table 1, except for A-rating bonds the average returns and standard deviations are increasing with durations and credit ratings. The average return on the 4-year, A-rating bond is 1.44E-6 higher than that of the 4-year, AA-rating bond. The higher number is negligible and potentially due to statistical estimation. The skewnesses and kurtoses are large especially for poor-rating bonds; the Jarque-Bera tests reject the normality hypothesis for all the bonds at a 99%-confidence level. Finally, all the returns show significant, positive autocorrelation. The positive autocorrelation supports the use of the White (1980) heteroskdasticity-consistent covariance matrix in the analyses.

In a study of U.S.A. treasury bill, Gibbons and Hess (1981) pointed out that daily returns equaled a one-day interest rate plus capital gain due to yield changes. So, the returns tended to be non-stationary and had to be differenced to obtain stationarity. In this study, the AR(1) coefficients of bond returns are small from 0.08 to 0.22. They do not suggest non-stationarity. Hence, return differencing is not needed.

Empirical Results

Table 2 reports regression coefficients and Wald statistics for the DoW hypothesis tests. The coefficients can be interpreted as average returns on the five weekdays. It is important to note that returns are positive, significantly different from zero, and highest on Friday for all the sample bonds–meaning the bonds show a high-Friday-return pattern. Nevertheless, the Wald tests reject the equal-weekday-return hypothesis only for 2-year and 4-year, AAA-rating bonds, 4-year, AA-rating bonds, 2-year and 4-year, A-rating bonds, and 2-year, BBB-rating bonds. These findings lead me to conclude that DoW effects exist in Thailand's corporate-bond markets. Despite the fact that all corporate bonds consistently show a pattern of positive and high Friday returns, significant DoW effects are specific to some bonds of certain durations and credit ratings.

Statistics	AAA			AA			A			BBB		
	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y
Average	1.25E-04	1.50E-04	1.73E-04	1.29E-04	1.55E-04	1.78E-04	1.33E-04	1.56E-04	1.77E-04	1.59E-04	1.80E-04	1.97E-04
S.D.	7.72E-04	1.20E-03	1.80E-03	7.96E-04	1.22E-03	1.81E-03	7.22E-04	1.10E-03	1.65E-03	9.46E-04	1.66E-03	2.61E-03
Skew	0.3916	0.0369	-0.4470	2.4188	2.0648	0.9678	-0.1891	-1.2132	-1.6325	-9.6454	-10.2734	-8.8797
Kurt	22.9359	22.7978	22.7137	46.0493	42.8077	30.6383	20.1160	29.2619	27.8505	274.0586	293.2431	251.9452
JB	4.70E+04***	4.64E+04***	4.61E+04***	1.91E+05***	1.65E+05***	8.41E+04***	3.61E+04***	7.69E+04***	7.02E+04***	6.74E+06***	7.71E+06***	5.69E+06***
AR(1)	0.1595***	0.1767***	0.2045***	0.1418***	0.1613***	0.1957***	0.1676***	0.1929***	0.2199***	0.0834***	0.0766***	0.0755***

Note: *** indicates significance at a 99%-confidence level.

Table 1 Descriptive Statistics of Corporate-Bond Returns

Coefficients	AAA			AA			A			BBB		
	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y
δ_{Mon}	0.0092***	0.0103***	0.0094***	0.0086***	0.0091***	0.0076*	0.0097***	0.0107***	0.0097**	0.0136***	0.0160***	0.0166***
δ_{Tue}	0.0069*	0.0059	0.0083	0.0155***	0.0183**	0.0245**	0.0119***	0.0114*	0.0137	0.0140*	0.0156	0.0208
δ_{Wed}	0.0123***	0.0147**	0.0134	0.0104***	0.0113*	0.0085	0.0134***	0.0162***	0.0155*	0.0162***	0.0191***	0.0185*
δ_{Thur}	0.0099**	0.0136**	0.0117	0.0109***	0.0159***	0.0156*	0.0094***	0.0135**	0.0123	0.0097**	0.0100	0.0041
δ_{Fri}	0.0240***	0.0304***	0.0434***	0.0191***	0.0225***	0.0324***	0.0217***	0.0261***	0.0369***	0.0261***	0.0295***	0.0385***
Wald	11.2829**	9.7300**	13.2206**	6.0027	4.8639	8.7242*	9.9538**	7.4170	12.4358**	8.9916*	3.9921	4.5666

Note: ***, ** and * indicate significance at 99%-, 95%- and 90%-confidence levels, respectively. All the coefficients are scaled up by 100.

Table 2 Test for Day-of-the-Week Effects in Corporate-Bond Returns

Discussion

Explanations

Only a few studies offered possible explanations for DoW in fixed-income-securities markets. Gibbons and Hess (1981) proposed that the DoW effects in the U.S.A. treasury-bill market might result from the settlement procedure; the explanation was not successful. Also in a New Zealand study, although Keef and Roush (2004) adjusted the returns to account for benefits from the settlement procedure, the effects still existed. Bildik (2001) related the falling Turkish overnight rates on Wednesday with the auction and redemption of public-borrowing assets. Despite detailed discussion, Bildik did not provide any supporting evidence except for showing that the redemption took place on Wednesday about 60 percent of the time. The only successful explanation is from Khanthavit (2016)– who showed empirically that the positive and high Thursday and Friday returns on Thailand's government bonds were driven by new information disseminated into the market from Wednesday auctions of very-long-term bonds.

It is important and interesting to explain why corporate bonds in Thailand's market have a high-Friday-return pattern. I propose two possible explanations and will test them empirically. The first possible explanation is a spillover effect from the stock-market returns and the second is a spillover effect from government-bond-market returns. I propose the spillover effects because stock and bond returns in national markets are not independent and investors adjust their investment portfolios among these asset classes all the time (Khanthavit, 2016). Moreover, Khanthavit and Chaowalerd (2016) reported significantly positive Friday returns on the broad-based, Stock-Exchange-of-Thailand (SET) index portfolio; and Khanthavit (2016) reported significantly positive Thursday and Friday returns on the government bonds. These findings align with the high, positive Friday returns found for the corporate bonds.

Before I test the two proposed explanations, I'd like to note that other alternative explanations have been proposed in the literature. But it is unlikely these explanations are successful. The data-snooping explanation by Sullivan, Timmermann, and White (2001) is irrelevant to this study because this study is the first study that examines the DoW effects in Thailand's corporate-bond market. Its sample includes all the daily observations available in the Thai BMA's database. The study addressed statistical misspecifications (Connolly, 1989; Chen, Lee, and Wang, 2002) by White's (1980) heteroskdasticity-consistent covariance matrix. A mispricing explanation (Keim & Stambaugh, 1984) is not consistent with the positive AR(1) coefficients in Table 1. I do not propose the spillover effect from foreign bond markets (Choudhry, 2000; Brooks & Persand, 2001) or the order-flow effect (Miller, 1988; Abraham & Ikenberry, 1994) because Khanthavit (2016) reported that these two effects could not explain the DoW effects in Thailand's government-bond market. The auction effect (Khanthavit, 2016) is not possible because corporate-bond offerings do not have fixed schedules. Finally, settlement-procedure (Gibbons & Hess, 1981), Friday-optimistic-investors (Pettengill, 1994), and speculative-short-selling (Chen & Singal, 2003) explanations cannot be correct. If there were, the study had to find the DoW effects for all, not some, of the sample bonds.

Explanation 1: stock-market spillover

I consider the model in Equation (2), as in Khanthavit (2016) and Khanthavit and Chawalead (2016), to test for the stock-market-spillover explanation.

$$r_t = \delta_{Mo} D_{Mo,t} + \delta_{Tu} D_{Tu,t} + \cdots + \delta_{Fr} D_{Fr,t} + \beta r_t^* + \varepsilon_t, \qquad (2)$$

where r_t^* is the return on the referenced market, from where the DoW effect spills. Because the referenced market is the Stock Exchange of Thailand, I will measured r_t^* by daily logged difference of the SET index. I obtain the SET-index data from the Stock Exchange of Thailand. If the stock-market spillover can explain the DoW effects, the Wald test will not be able to reject the equal-weekday-return hypothesis of $\delta_{Mo} = \cdots = \delta_{Fr}$. The test are conducted only for those six bonds, consisting of the 2-year and 4-year, AAA-rating bonds, 4-year, AA-rating bonds, 2-year and 4-year, A-rating bonds, and 2-year, BBB-rating bonds, that exhibit significant DoW effects.

The test results are in Table 3. The β coefficients are not significant. The stock and corporate-bond returns are not correlated. The Wald tests still reject the hypotheses for these six bonds. These findings lead me to conclude that the stock-market spillover cannot explain the DoW effects in the corporate-bond market.

Explanation 2: Government-bond-market spillover

I apply Equation (2) to test for the government-bond-market-spillover explanation by substituting r_t^* for the returns on duration-corresponding, constant-maturity government bonds. Following Khanthavit (2016), the corresponding government-bond returns are computed from minus spot-yield differences timed duration. The spot yields are retrieved from the Thai BMA's database. The results are in Table 4.

From Table 4, the β coefficients are positive and significant for the six bonds with significant DoW effects. The movement of government-bond returns can explain the movement of corporate-bond returns. But can the government-bond returns successfully explain the DoW effects? The Wald-test results suggest that they can. The tests cannot reject the equal-weekday-return hypothesis for any of the six bonds. I conclude that the DoW effects in Thailand's corporate-bond market spill over from the government-bond market.

Examining DoW effects in Spread Returns

Corporate-bond returns can be decomposed into government-bond returns and spread returns. The spread returns compensate investors for accepting higher risks, e.g. credit and liquidity risks, of corporate bonds over and above those of government bonds. It is interesting to ask whether spread returns exhibit DoW effects. The answer to this question is important because the DoW effects in spread returns, if they exist, will help investors to improve their credit-derivatives strategies.

In order to test for DoW effects in the spread returns, I revert to the model in Equation (1) where I substitute r_t for spread returns. The calculation of the spread-return data is straightforward. They are corporate-bond returns minus government-bond returns. If the DoW effects exist, the Wald test must reject the same-weekday-return hypothesis. The results are in Table 5. The spread returns are positive on all weekdays for all the sample bonds. This result is expected because the spread returns are the compensation for additional risk taking. In most cases, the spread returns are highest on Friday. But the Wald tests cannot reject the hypothesis for any of the bonds. Hence, I conclude that the DoW effects do not exist in the spread returns.

Coefficients	AAA			AA			A			BBB		
	2Y		4Y		4Y	2Y		4Y	2Y			
δ_{Mon}	0.0092***		0.0095***		0.0076*	0.0097***		0.0097**	0.0136***			
δ_{Tue}	0.0069*		0.0083		0.0245**	0.0119***		0.0137	0.0140**			
δ_{Wed}	0.0123***		0.0133		0.0085	0.0134***		0.0155*	0.0162***			
δ_{Thur}	0.0099**		0.0117		0.0156*	0.0094***		0.0123	0.0096**			
δ_{Fri}	0.0240***		0.0432***		0.0324***	0.0217***		0.0369***	0.0260***			
β	0.0336		0.1433		-0.0071	0.0026		0.0221	0.0197			
Wald	11.2956**		13.0485**		8.7602*	10.1772**		12.5930**	9.1809*			

Note: ***, ** and * indicate significance at 99%-, 95%- and 90%-confidence levels, respectively. All the coefficients are scaled up by 100.

Table 3 Tests for Stock-Market-Spillover Explanation

Coefficients	AAA			AA			A			BBB		
	2Y		4Y		4Y	2Y		4Y	2Y			
δ_{Mon}	0.0099***		0.0114**		0.0096	0.0103***		0.0116**	0.0142***			
δ_{Tue}	0.0069***		0.0073		0.0235***	0.0119***		0.0126*	0.0140**			
δ_{Wed}	0.0099***		0.0109*		0.0060	0.0110***		0.0130***	0.0139***			
δ_{Thur}	0.0090***		0.0108*		0.0147***	0.0085***		0.0114***	0.0087***			
δ_{Fri}	0.0183***		0.0278***		0.0170***	0.0162***		0.0218***	0.0205***			
β	85.0766***		80.0847***		79.0390***	82.3379***		77.9326***	82.7079***			
Wald	5.8852		5.8797		4.7288	4.8861		4.6959	6.5689			

Note: ***, ** and * indicate significance at 99%-, 95%- and 90%-confidence levels, respectively. All the coefficients are scaled up by 100.

Table 4 Tests for Government-Bond-Market-Spillover Explanation

Coefficients	AAA			AA			A			BBB		
	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y	2Y	3Y	4Y
δ_{Mon}	0.0100***	0.0101***	0.0118*	0.0093***	0.0089*	0.0101	0.0105***	0.0105**	0.0122*	0.0144***	0.0158***	0.0190**
δ_{Tue}	0.0069**	0.0064	0.0070	0.0155***	0.0189***	0.0232***	0.0119***	0.0120**	0.0123*	0.0140**	0.0162	0.0195
δ_{Wed}	0.0094***	0.0102***	0.0102**	0.0075***	0.0068**	0.0054	0.0105***	0.0117***	0.0123***	0.0134***	0.0146***	0.0153**
δ_{Thur}	0.0088***	0.0102**	0.0106*	0.0098***	0.0125***	0.0145***	0.0083***	0.0101***	0.0112***	0.0086***	0.0066	0.0030
δ_{Fri}	0.0173***	0.0221***	0.0239***	0.0123***	0.0142***	0.0130**	0.0150***	0.0179***	0.0175***	0.0193***	0.0213***	0.0190*
Wald	4.9281	5.6295	3.8017	3.2113	4.1507	4.4140	0.0105	3.8894	1.6730	5.6219	3.7673	3.0856

Note: ***, ** and * indicate significance at 99%-, 95%- and 90%-confidence levels, respectively. All the coefficients are scaled up by 100.

Table 5 Tests for Day-of-the-Week Effects in Spread Returns

Dominance Effects

I argued that test results could be misleading if researchers use composite bond-index or mixed-bond-portfolio returns in a DoW study because the duration and credit ratings are not fixed (Flannery & Protopapadakis, 1988). Existence (Nippani & Arize, 2008) or inexistence (Jordan & Jordan, 1991) of DoW effects might have been driven by the returns of dominant bond sub-groups. Next, I will reconcile my argument by re-examining the DoW effects with the returns on the Thai BMA index portfolio of BBB-rating bonds and better. Because the index is constructed for calendar days not trading days, its return will be computed by a logged-index difference divided by the number of calendar days between the two trading days. The test results for DoW effects in the BBB-and-better, bond-index returns are in Table 6. The returns are positive for all weekdays and highest on Friday. This return pattern is consistent with those of the bonds with fixed durations and credit ratings in Table 2. However, the Wald test cannot reject the hypothesis of equal weekday returns. So, if the researchers considered composite-index portfolios in their studies, they would conclude incorrectly that DoW effects did not exist in Thailand's corporate-bond market.

Coefficients	Level
δ_{Mon}	0.0108^{***}
δ_{Tue}	0.0131^{**}
δ_{Wed}	0.0131^{**}
δ_{Thur}	0.0163^{***}
δ_{Fri}	0.0190^{***}
Wald	5.2555

Note: *** and ** indicate significance at 99%- and 95%-confidence levels, respectively. All the coefficients are scaled up by 100.

Table 6 Test for Day-of-the-Week Effects of BBB-and-Up, Bond-Index Returns

Conclusion

Information on price patterns on weekdays, a.k.a. days-of-the-week effects, of corporate bonds helps investors to choose the best days of the week to execute their trades. In this study, I tested for the day-of-the week effects in Thailand's corporate-bond market. The market is one of the most important markets in the South-East Asian region in terms of size and growth. Yet, such important tests have never been conducted for the market. This study is the first. The data are daily returns on the Thai Bond Market Association's ZRR index portfolios for corporate bonds. The indexes are duration- and credit-specific so that their returns characteristics are fixed over the sample period. The data set enabled me to resolve the problem of changing return characteristics in previous studies in which composite-bond-index returns or mixed-bond-portfolio returns were used.

The study found high, positive Friday returns for all the bonds in the sample. The DoW effects existed in Thailand's corporate-bond market; but the DoW effects were significant only for some of the bonds. I empirically tested two possible alternative explanations of the Friday effects, i.e. stock-market spillover vs. government-bond-market spillover, and concluded that it was the government-bond-market spillover that successfully explained the significant effects. Finally, I showed that the use of composite-corporate-bond index returns could be misleading. For Thailand's corporate-bond market, if researcher considered, for example, Thai BMA corporate-bond-index returns of BBB ratings and better, they would conclude incorrectly that DoW effects did not exist in Thailand's corporate-bond market.

The study is traditional and primary. It provides and successfully explains the stylized facts on Friday effects for Thailand's corporate-bond market. In the literature, e.g. Doyle and Chen (2009), DoW effects may be wandering over time. I leave the study of wandering DoW effects for future research.

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