Corporate Bond Returns and Weekday Seasonality

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Abstract

This study examines trading day and calendar day returns-generating processes and tests the weekend effect in the corporate bond market. We reject the calendar day hypothesis while the trading day hypothesis cannot be rejected as the corporate bond's returns-generating process. Furthermore, we find a "reverse" weekend effect in the corporate bond market in that Monday returns are on-average positive and statistically significant in this sample.

I. Introduction

Studies show that there is generally a negative price change across weekends in the equity markets, but what about the corporate bond prices? In this study, the behavior of corporate bond prices across weekends is analyzed, using the Merrill Lynch corporate bond index. Specifically, we test the calendar day and the trading day hypotheses in corporate bond markets.

According to the trading day hypothesis, bond returns- including accrued interest payments- are based solely on the active trading day. That is, the bond market must be active to provide price changes that result in returns generation. However, according to the calendar day hypothesis, bond returns accumulate on the basis of the number of elapsed calendar days. Since financial markets are closed on weekends, the calendar day hypothesis predicts that returns for Saturday and Sunday are stored and reflected in Monday's return. Therefore, based on this hypothesis, Monday returns should be three times the size of returns of other weekdays.

The processes that generate stock returns are the subjects of papers by Fama (1965, 1970, 1976), French (1980), Lakonishok and Levi (1982), Rogalski (1984), Keim et al. (1984), Jaffe and Westerfield (1985), Smirlock and Starks (1986), and Board and Sutcliffe (1988). Other recent research efforts have sought to determine the effect of the day of the week on currency returns, stock returns, stock index futures, and gold markets [see Dyl and Maberly (1986,1988), Ma (1986), Junkus (1986), among others]. These studies show that the prices of these financial investment instruments drop abnormally on Mondays. This well documented phenomenon is known as the "weekend effect." Researchers agree on the existence of the weekend effect; however, the source of this phenomenon has been elusive and does not easily lend itself to verification.

Flannery and Protopapadakis (1988) examine intraday returns' seasonality in Treasury bills (T-bill), bonds (T-bonds), and stocks and find that T-bills exhibit a small but statistically significant negative return on Mondays. They use data taken from individual T-bills and T-bonds and adjust the returns for an "approximately constant `nominal' maturity." Adrangi and Hensler (1989) test Shearson Lehman Hutton Treasury bond indices (present Lehman Brothers indices) and find a positive and significant return on Mondays for both short- and long-term T-bonds. Their regression results provide evidence supporting the calendar-day hypothesis of the returns-generating process in the T-bond market. They attribute the positive Monday returns in the T-bond market to a possible systematic movement of funds from equity into bond markets. Jordan and Jordan (1991) analyze the daily Dow Jones Composite Bond Average (DJCI) for January 1963 through December 1986 and find that seasonality patterns for corporate bond prices are not similar to those of equities. Daily corporate bond returns based on DJCI are statistically equal, lending support to the trading day hypothesis. They show that the day-of-the-week effect is more evident in the stock market than it is in the bond market. This, they suggest, may stem from the institutional difference between the equity and bond markets. The methodology, time periods, and the index explained in sections II and III, are different from those of Jordan and Jordan.

The purpose of this study is to examine returns in the corporate bond market. Statistical tests are performed in the context of the day-of-the-week analysis. Both trading day and calendar day returns-generating processes are examined and the weekend effect is tested.

We reject the calendar day hypothesis while the trading day hypothesis cannot be rejected as the returns-generating process in the corporate bond market (1). Furthermore, we find a "reverse" weekend effect in the corporate bond market in that Monday returns are on-average positive and statistically significant in this sample.

This paper is organized as follows: Section II describes the methodology and the empirical models used in the study. Section III describes the data and variables used in the study. Section IV presents the test results. Section V provides conclusions.

II. Methodology

This study tests two hypotheses regarding the effect of the day of the week on bond returns: the trading day hypothesis and the calendar day hypothesis. This paper differentiates between the trading day hypothesis and the calendar day hypothesis using several tests. First, the study performs an analysis of variance (ANOVA) on the average daily returns where the null and the alternative hypotheses are

Ho: $E(BR_1)=E(BR_2)=E(BR_3)=E(BR_4)=E(BR_5)$,
Ha: At least some of the daily expected returns are unequal. (1)

E(BR) represents the average daily returns for day i from 1 to 5, corresponding to Monday through Friday, respectively. The F-statistic of the analysis of variance tests this hypothesis.

Next, this study estimates two regression equations for the corporate bond index. The first regression equation tests the equality of the daily returns using a regression line with four dummy variables as follows(see French 1980):

$$BR = \alpha + \beta_2 D2 + \beta_3 D3 + \beta_4 D4 + \beta_5 D5 + u_t. \quad (2)$$

where BR is the daily return of a bond index, and D2 through D5 are the daily dummy variables for Tuesday through Friday, respectively. For example, D2 is 1 if the day is Tuesday, 0 if not Tuesday. The intercept measures Monday returns. The coefficients β2 through β5 measure the difference between Monday returns and the returns on Tuesday through Friday, respectively. If the trading day hypothesis holds, then the F-statistic for the above regression should be insignificant, leading one to accept the following null hypothesis:

$$Ho: \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0. \quad (3)$$

Accepting this null hypothesis implies that the trading day hypothesis holds and returns for all the days of a week are statistically equal. This would replicate the ANOVA results.

This study tests the calendar day hypothesis by testing the following restrictions in equation (2):

$$\begin{aligned} \beta_2 &= \beta_3 = \beta \\ \beta_3 &= \beta_4 = \beta \\ \beta_4 &= \beta_5 = \beta, \end{aligned} \quad (4)$$

where β is assumed to be the common marginal contribution to base return which is average Monday return. This restriction is necessary to insure that the returns of the days other than Mondays are equal as implied by the calendar day hypothesis. Substituting conditions in (4) into equation (2) and collecting the terms results in equation (5):

$$BR = \alpha + \beta(D2 + D3 + D4 + D5) + u_t. \quad (5)$$

To arrive at the restricted formulation of equation (2) we substitute D for (D2 D3 D4 D5):

$$BR = \alpha + \beta\ D + u_t. \quad (6)$$

In equation (6) if D is zero then BR is the average Monday return, if it is one, then BR represents the average returns of the remaining days of a week. Substituting zero and one for D in equation (6), we get α and $\alpha+\beta$ for average returns of Monday and Tuesday through Friday, respectively. If the calendar day hypothesis is the true returns-generating process, then the following restriction also should hold:

$$\alpha = 3(\alpha+\beta). \quad (7)$$

From equation (7) $\beta= -2/3\alpha$. Substituting this for in equation (6) produces the following restricted form of equation (2):

$$BR = \alpha(1 - 2/3\ D) + u_t. \quad (8)$$

Note that in equation (8) if D is zero $BR=\alpha$ and if it is one $BR=1/3\alpha$ as would be required by the calendar day returns-generating process. If restrictions in (4) and (7) are valid the sum of squared errors of regressions (8) and (2) should not be significantly different. This is tested by the following F-statistic:

$$F = \frac{[(SSE_r - SSE_u)/K_1]}{SSE_u/(N-K)}. \quad (9)$$

N represents the number of observations, K1 represents the number of restrictions, K is the number of explanatory variables in Equation (2), and SSE is the sum of squared errors from each regression equation where subscripts u and r represent the unrestricted and restricted SSE from Equations (2) and (8), respectively. If this F-statistic is insignificant, then the restriction in (4) and (7) are valid, indicating that the calendar day hypothesis explains the daily returns-generating process. Otherwise, the restrictions are not valid and the calendar day hypothesis is rejected. We use robust estimation technique in order to correct for the possible heteroscedasticity that may exist among the residuals of returns distributions across the days of a week. Ignoring the problem of heteroscedasticity can lead to upward bias in the estimates of the coefficient standard deviations and thus, spurious t-statistics.

III. Data and Variables

The study uses the index of daily values of the Merrill Lynch Corporate bond index for the period of November 3, 1986 through February 11, 1991. This index includes bonds with maturity dates from one to thirty years with an average maturity of approximately twelve and a half years. The daily value of the index includes the price fluctuations and the accrued interest (2).

Assuming a continuous accumulation of returns with a random error, the following equation computes the daily index total returns [see French (1980)]:

$$P_t/P_{t-1} = \exp(BR_t + \epsilon_t). \quad (10)$$

Pt and Pt-1 are the daily values of the index for two consecutive days of trading. The index includes trading adjustments for coupon accumulations. Following French (1980) the days following holidays are deleted from the data set (3). Taking the logarithm of both sides of Equation (10) yields

$$Ln(P_t/P_{t-1}) = BR_t + \epsilon_t. \quad (11)$$

The expected value of the logarithm of the ratio of the two consecutive values of the index provides the expected daily bond returns:

$$E[Ln(P_t/P_{t-1})] = E(BR_t). \quad (12)$$

Assuming that t in Equation (12) satisfies the classical econometric assumptions, its expected value equals zero. The natural log of the daily total value index ratio is used here to denote the daily bond return.

IV. Empirical Results

This section analyzes the results of the tests described in Section III. Table 1 summarizes the descriptive statistics of the data. Monday returns on the average are positive and statistically significant. This result indicates that, unlike stock markets, one does not observe a negative return in the bond market for Mondays. The returns of the remaining days of the week, except Tuesdays, are all positive, and statistically significant, but less than Monday returns. These results are not surprising as the index includes accrued interest as well as price fluctuations. Therefore, the accumulation of the interest on Mondays results in a daily return which is higher than the returns of the remaining days of a week. However, as Jordan and Jordan (1991) explain the accrued daily interest for Mondays cannot be material. Our ANOVA results, which are explained later, seem to show this point statistically.

Table 2 presents the results of the analysis of variance test of the hypotheses in equation (1). The F-statistic shows that the average returns for the MLCB index are statistically identical across days of trading at the 5 percent confidence level. The emerging pattern indicates that the value of a portfolio of corporate bonds with mixed maturity dates shows very little fluctuation across days of the week. Therefore, one concludes from the ANOVA results that the trading day hypothesis cannot be rejected. To corroborate this results, we estimate regression equations (2) and (8) and test the calendar day hypothesis explicitly.

Table 3 presents the estimation results of Equation (2). Regression results for the index show that Monday returns are positive and statistically significant at the 5 percent level. The returns of the remaining days of a week are all less than returns on Mondays as shown by the negative sign of marginal returns of Tuesday through Friday (4). However, the drop in the value of the index is not statistically significant as shown by the insignificance of the F statistic. The F ratio is less than the critical value of F at all commonly used confidence levels indicating that 2 through 5 are statistically insignificant. These results corroborate the ANOVA results and indicate that the trading day hypothesis again cannot be rejected using either method: Monday returns are shown to be positive and significant and marginal returns of the remaining days of the week are negative but insignificant. Therefore, bond returns are statistically identical across the days of a week.

Table 4 presents the results of the regression estimates that test the calendar day hypothesis as expressed in Equations (2) and (8). The value of the F-statistic in equation (9) is significant at 1 percent level indicating that the index does not follows the calendar day returns-generating process. This result appears to reinforce the results of the F tests reported earlier. We conclude that, in our sample, the trading day hypothesis seems to explain the returns-generating process. This result is different from the results obtained by French (1980) in the equity market. Using daily returns of the S&P composite portfolio for the period of 1953-1977, he rejects either hypotheses as the return generating processes for his entire sample and all but one of his sub-samples. For one subsample he fails to reject either hypothesis. Our results are similar to those of Adrangi and Hensler (1989), who find that the Monday returns are positive and significant and trading day returns-generating process cannot be rejected in the T-bonds market.

One ramification of the findings of the day-of-the-week tests is that, ignoring transaction costs, and assuming that the trading day hypothesis holds true, a trader cannot profit from returns volatility on a daily basis in a well diversified corporate bond market. For example, by systematically selling bonds on Mondays, a trader cannot enhance trading gains in this market over the long run.

A second significant finding is that, contrary to the findings of Flannery and Protopa

Table 1
Means of Daily Bond Returns for Merrill Lynch Corporate Bond Index

	Monday	Tuesday	Wednesday	Thursday	Friday
No. of observations	200	202	218	214	208
Mean	0.05	0.028	0.033	0.029	0.038
Standard deviation	0.018	0.022	0.016	0.018	0.023
t-statistic	(2.67)*	(1.27)	(2.06)**	(1.61)***	(1.65)**

* significant at the 1 percent level
** significant at the 5 percent level
*** significant at the 10 percent level
Note: Returns are multiplied by 100.

Table 2
Analysis of Variance of Mixed Term ML Corporate Bond Index
Source of Variation - Days of the Week; n=1042

Category	Source	SS	DF	MS	F-statistic
MLCB	Days				
	Explained	0.065	4	0.016	
	Residual	83.27	1037	0.80	0.203
	Total	83.34	1041		

Notes: SS and MS are the sum of Squares and Mean squares, respectively. Source indicates the source of variation. The hypotheses to be tested are :

Ho: $E(BR_1) = E(BR_2) = E(BR_3) = E(BR_4) = E(BR_5)$,
Ha: At least some of the daily expected returns are unequal.

Table 3
Robust Regression Results for the Trading Day Hypothesis
Equation 2: $BR = \alpha + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + u_t$
n=1042

Category	α	β_2	β_3	β_4	β_5	R^2	D-W	F-stat
MLCB								
Coefficient	0.00049	-0.00022	-0.00017	-0.00021	-0.00012	0.0006	1.77	0.65
t-statistic	(2.67)*	(-0.77)	(-0.68)	(-0.81)	(-0.40)			

* significant at the 5 percent level

Table 4
Robust Regression Results for Tests of the Calendar Day Hypothesis
Equation 2 Unrestricted: $BR = \alpha + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + u_t$
n=1042

Category	α	β_2	β_3	β_4	β_5	SSE_u
MLCB						
Coefficient	0.00049	-0.00022	-0.00017	-0.00021	-0.00012	0.008327
t-statistic	(2.67)**	(-0.77)	(-0.68)	(-0.81)	(-0.40)	

Equation 5 Restricted: $BR = \alpha (1 - 2/3 D) + \varepsilon_{rt}$
n=1042

Category	α	SSE_r
Coefficient	0.00064	0.008342
t-statistic	(4.05)*	

$F = [(SSE_r - SSE_u) / K_1] / [SSE_u / (N-K)]$
F = 4.68*

* significant at the 1 percent level
** significant at the 5 percent level

padakis, Mondays do not appear to produce a negative return for this bond index. This may partially explain the negative Monday returns found in the stock market. That is, if one assumes sufficient investor liquidity to cope with differences in clearing periods, there may be a systematic movement from the stock market into the bond market across weekends. This, however, should be researched further.

A third ramification of the findings is that the daily index fluctuations in the corporate bond market appear to be insignificant. Monday index returns, despite a three-day accrued interest, are not significantly different from the returns of other days of the week. This finding is similar to the insignificance of the daily accumulation of dividends in equity markets as discussed by French (1980).

V. Conclusion

The purpose of this study is to analyze the daily returns-generating process and test for the existence of the weekend effect in the corporate bond market using an index of corporate bonds. The daily values of the Merrill Lynch index of corporate bonds for the period of November 3, 1986 through February 11, 1991 comprise the data set. This study uses regression analysis and analysis of variance as its research methodology.

The trading and calendar day hypotheses of returns-generating process are tested. According to the trading day hypothesis, bond returns- including accrued interest payments- are invariant across trading days. However, the calendar day hypothesis maintains that bond returns accumulate on the basis of the number of elapsed calendar days. Thus, the calendar day hypothesis predicts that Monday's returns are three times the size of returns of other weekdays.

The results of the study indicate that the trading day hypothesis seems to explain the returns-generating process in the corporate bond market. Furthermore, in contrast to equity markets, corporate bond markets show a "reverse" weekend effect; that is, Monday returns are positive. One explanation may be that investors restructure their portfolios moving from equities to bonds across weekends. However, further data and research are needed to verify this.

Suggestions For Future Research

Three extensions and suggestions for future research may be appropriate. First, corporate bonds with long-, medium, and short-term maturity may be examined to see whether there is a significant difference in their behavior. Sort-term corporate bond indices may behave similar to equity indices, while long- and medium-term indices may not. Second, it may be worthwhile to examine the effects of treasury bond auctions on corporate bond indices. Corporate and government bonds of similar terms may be substitutes for each other in investors' portfolios. Therefore, treasury bond auctions may have an impact on corporate bond market. Finally, the substitution between equities and corporate bonds may be examined for the source of the observed anomaly in the corporate bond market. Flows of cash out of equity markets and into corporate bonds may be responsible for the "reverse" weekend effect observed in this paper.

Endnotes

1. This finding corroborates the findings of the Fixed Income Research Department at the Merrill Lynch.
2. The Fixed Income Research Department of Merrill Lynch constructs various bond indices. The corporate bond index is computed based on a base price which is set equal to 100 in the base year. The base price is the sum of the weighted average price and the weighted average accrued interest at the beginning of the measurement period. The weighted average price is computed by multiplying the par amount outstanding of each bond in the index by its flat price (i.e., without accrued interest). The sum of those products is then divided by the total par value of the index. To compute the weighted average accrued interest, the par amount outstanding of each issue is multiplied by its accrued interest. Accrued interest is calculated assuming same-day settlement. The sum of these products is then divided by the total par value of the index.
3. Bond returns on days after holidays may be different from Mondays. Holiday weekends usually cover more than three calendar days while mid-week holidays are only two days. Following French (1980) the days after holidays are tested separately because including them could distort the test of the calendar day hypothesis. Thirty six observations in this category provide limited observations for statistical reliability. However, applying the tests explained in the paper, neither trading day nor calendar day returns-generating hypotheses could be rejected. Estimation of equation (2) showed that Monday returns are negative, and marginal returns of the remaining days of a week are positive but statistically insignificant. These results are not reported but are available from the authors upon request.
4. Results reported in Table 3 verify the average returns reported in Table 1. If we algebraically sum with $\beta 2$ through $\beta 5$, respectively, and multiply the result by 100, we obtain the average daily returns reported in Table 1. The statistical insignificance of $\beta 2$ through $\beta 5$ indicates that these differences are not material enough to render the daily returns unequal. These results verify the conclusions of the ANOVA test in Table 2.

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