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Accounting year-end dispersion and seasonality in the Japanese corporate bond market^{*}

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Abstract

Using monthly yield data on straight bonds, this paper investigates seasonality in the Japanese corporate bond market. A statistical examination of spreads between the yield of each bond and a bond market index reveals that the yield spread consistently decreases from April to August, whereas it increases from September to December. Because accounting year-ends for most investors in Japan are concentrated in either March or December, this seasonality supports the hypotheses of tax-loss selling and window dressing. Moreover, the seasonality becomes more pronounced as the debt rating declines, consistent with the findings in previous studies investigating the US bond market.

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I. Introduction

In the finance literature, various kinds of seasonality and anomalies associated with corporate securities prices have attracted attention from researchers. Although anomalies found primarily in equity markets have been well documented, the body of research on corporate bonds is relatively small compared with that on equities. Using monthly yield data on corporate straight bonds in Japan over a period of approximately 10 years, this paper investigates monthly anomalies in the Japanese corporate bond market and explores the factors associated with the seasonality.¹ For this purpose, I first calculate the spread between the yield of a corporate straight bond and the yield of the Nikkei bond index, which is an aggregate measure of the Japanese government bond market. Then, I examine the spread observed over the sample period and utilize statistical analysis, whereby the yield spreads are regressed on monthly dummies with controls for credit quality, maturity, and other factors. The results, which will be of interest to both academic finance researchers and portfolio managers, are as follows.

Above all, the analysis reveals the existence of consistent seasonality, in that the yield spread significantly decreased from April to August, but increased from September to December. Moreover, I provide evidence that this seasonality becomes more pronounced as the debt rating declines, which is consistent with the findings in the literature investigating the US bond market (Chang and Pinegar, 1986; Maxwell, 1998; Barnhill *et al.*, 2000). The accounting year-end for most Japanese companies and private pension funds is the end of March, whereas that for small investors, including sole proprietorships and individual investors, is the end of December, as specified by Japanese tax laws. Hence, the seasonality observed in the yield spread appears to support the hypotheses of tax-loss selling and window dressing that have been confirmed in previous studies examining the US corporate bond market. The tax-loss selling hypothesis has been one explanation for monthly seasonality of securities prices. It surmises that prices are depressed at the year-end owing to intensified pressure from investors for firms to sell shortly before the taxable year-end in order to lower their taxes. However, the prices rebound at the start of the month of the new fiscal year. On the other hand, the window dressing hypothesis suggests that investors are likely to unload bonds with poorer credit qualities at the accounting year-end and then gradually buy them back after the new accounting year starts. As a result of these investor behaviours, and the variations in accounting year-ends for Japanese firms, the price of corporate debts appreciates from April, which is the beginning of the fiscal year for most Japanese firms, and continues to increase toward the middle of the year, reflecting an upward trend in demand caused by the reversal of firms' positions on corporate debt following the end of the fiscal year. On the other hand, gradual price depreciation occurs toward December, when the taxable year of many investors ends, implying that the firms tend to divest themselves of corporate bonds with a higher default risk.

¹ Matsui (2006) investigated the issue conditions of corporate bonds determined in the primary market in order to explore the pricing mechanisms of debt IPOs and SPOs in Japan. He found that the issue price of a bond tends to be significantly overpriced on average compared with the bond's price in the secondary market.

Another supplementary conclusion is that the yield spread falls as the issue amount of the bond becomes greater, which may reflect the liquidity premium associated with bonds. Finally, the yield spread tends to decrease when investors hold greater amounts of corporate bonds, indicating that the investors' greater demand for bonds raises their prices.

The present paper is organized as follows. Section II reviews the previous literature exploring corporate bond market seasonality, and suggests possible hypotheses explaining monthly anomalies in the corporate bond market. The data set used is described in Section III, followed by an empirical investigation of the yield spreads, calculated from the data in Section IV. Section V concludes the paper.

II. Theoretical Background

Literature review

Seasonality and monthly anomalies in corporate bond returns and yields in the US have been well documented in the literature (e.g., Chang and Pinegar, 1986; Chang and Huang, 1990; Jordan and Jordan, 1991; Fama and French, 1993; Hochman *et al.*, 1993; Cooper and Shulman, 1994; Maxwell, 1998; Barnhill *et al.*, 2000; Fridson, 2000). Chang and Pinegar (1986) revealed that a January seasonal trend in the US long-term corporate bond market becomes more evident as the debt rating deteriorates. They found a January effect for noninvestment grade debts, but not for investment grade debts or Treasury bonds. Using price data in the US corporate bond market from 1986 to 1997, Maxwell (1998) systematically estimated an error correction model incorporating the cointegration relationship between the yield rate of corporate bonds and the yield of a Treasury bond. He found that prices of bonds with a low credit quality rose in January, suggesting the existence of a 'small firm effect'. Further, he concluded that window dressing was a significant factor behind the January effect in noninvestment grade bonds. Barnhill *et al.* (2000) applied cointegration analysis techniques to examine the long- and short-run dynamics of the yields on noninvestment grade bond indices. Their estimation results suggested that a long-run equilibrium relationship exists between yields of corporate bonds, default rates, and yields of Treasury bonds.

The survey above indicates that the previous research has focused upon the US bond market, regardless of which hypothesis was being investigated. Therefore, research that investigates bond market issues in other advanced countries is likely to capture the interest of researchers and bond traders.²

Hypotheses for seasonality

Several possible hypotheses have been advanced to explain monthly anomalies in corporate bond pricing. As referred to earlier, the tax-loss selling hypothesis posits that

² On the other hand, substantial empirical studies have investigated seasonality of stock prices not only in advanced countries but also in emerging economies (e.g., Cheung and Coutts, 1999; Coutts and Sheikh, 2000; Jarrett and Kyper, 2005; Asteriou and Kavetsos, 2006; Ushad, 2009; Chang *et al.*, 2010).

investors sell securities on which they have losses in order to lower their tax on net capital gains shortly before the end of the tax year. Thus, while intensified selling pressure reduces prices at the end of the tax year, the prices rebound at the start of the first month of the fiscal year when such selling pressure dissipates, resulting in a large return during that month. Another hypothesis advanced to explain the seasonality is window dressing, which suggests that institutional investors are likely to unload bonds with poorer credit qualities at the accounting year-end if they are unwilling to be exposed as holding risky assets, but then they gradually buy the risky bonds back after the new accounting year starts (Lakonishok *et al.*, 1991).

As discussed, accounting term variations for Japanese companies possibly lead to monthly anomalies in Japanese securities markets. First, it should be noted that most Japanese firms set the end of their fiscal year in March, unlike many US firms. Fig. 1 illustrates the distribution of fiscal year-end months for major Japanese companies listed on the first section of either the Tokyo or the Osaka Stock Exchange, and indicates that 1327 out of 1603 firms close their accounts in March. Namely, 82.8% of the listed firms begin their taxable year on April 1, and end it on March 31. Accounting year-ends for private pension funds, which hold a large portion of corporate bonds, are also concentrated in March, because private companies manage these funds. Second, Japanese tax laws regulate that the fiscal year-end for all sole proprietorships and individual investors is December. Fig. 1 shows that 6% of the listed companies in Japan have December as their tax year-end, similar to typical firms in the United States. In summary, because the fiscal year-end of approximately 80% of major Japanese firms is March, while that of sole proprietorships and personal investors is December, we may expect monthly anomalies in the bond market to be generated before and after the accounting year-end months. If the tax-loss selling and window dressing hypotheses also account for the monthly anomalies in Japan, then yields of corporate bonds with a certain degree of default risk will rise in December and March, and fall in January and April. The following sections empirically test these hypotheses.

[Fig. 1]

III. Data Description

Because Japanese bonds are traded in the over-the-counter (OTC) market and not on exchanges, the Japan Securities Dealers Association (JSDA) collects data on original yields and prices of bonds from securities companies, and then sells the data to I-N Information Systems, LTD (INIS). Hence, the current study employs as primary data the I-N Firm Finance Data Base provided by the INIS. The database includes the daily yield rate in the secondary market, issue amounts, credit ratings, issue rates, the date of the issue, the maturity of the issue, and the number of the issue. Bonds issued by electrical power companies are excluded from the sample examined below because the market for electrical utility bonds is clearly distinguished from that of other general industrial bonds in Japan. Based on the dataset, I construct monthly yield data by using prices at the end of each month during the sample period. The primary data consist of 3813 corporate straight bonds

traded in the secondary market from January 1995, to March 2005. Additionally, I use the Flow of Funds Accounts compiled by the Bank of Japan as a supplementary data source to obtain the total amount of corporate bonds held by investors in each quarter during the period.

Next, to investigate the seasonality specific to the corporate bond market, we need to measure the relative discrepancy between the yield of each bond and an aggregate index of a risk-free asset, such as a government bond. Hence, I hereafter define the yield spread of each bond as the difference between the yield of the bond and the Nikkei government bond index, which captures the fundamental conditions of the Japanese government bond market:

(Yield Spread of a bond: $SPREAD_{it}$)

$$\begin{aligned} &\equiv (\text{yield rate of the bond on the last trading day of a month: } YIELD_{it}) \\ &\quad - (\text{Nikkei government bond index on the same day: } NIKKEI_t) \end{aligned} \quad (1)$$

Table 1 summarizes the descriptive statistics of the variables used in the following empirical analysis. Table 2 presents the correlation matrix between the variables, indicating that low correlation coefficients fortunately prevent multicollinearity in the regressions. Table 3 classifies the bonds by credit rating, and shows that the majority of companies have ratings assigned by the Rating & Investment (R&I) credit rating agency.

[Table 1]

[Table 2]

[Table 3]

IV. Empirical Investigation

Stationarity check

Before examining the data set using the regression method, we need to determine whether each variable series satisfies the stationarity. While previous studies (Maxwell, 1998; Barnhill *et al.*, 2000) have conducted unit root tests and found a cointegration relationship, it is worth noting that this research is the first to apply unit root tests for panel-form data sets to the investigation of corporate bond price seasonality.

First, I perform a Dickey–Fuller test on a single variable series of the Nikkei government bond index, where the null hypothesis is that the index includes the unit root, as follows:

$$\Delta NIKKEI_t = \alpha + \delta NIKKEI_{t-1} + \gamma TIME_t + \varepsilon_t \quad (2)$$

$NIKKEI$ represents the Nikkei government bond index on the last trading day of each month, $\Delta NIKKEI_t \equiv NIKKEI_t - NIKKEI_{t-1}$, and $TIME$ is the time trend variable, which starts with a value of one in the first month of the sample period and ends with a value of 123 in the final month. ε is the error term with a zero mean and finite variance. Panel A of Table 4 summarizes the results of the test based on Equation 2. The panel suggests that the low p -

value of the estimated coefficient rejects the null hypothesis, implying that the index includes no unit root.³

[Table 4]

Next, we determine whether the yield rate of corporate bonds has a unit root. Because the bond yield data take a panel form, we should perform unit root tests for the panel data. Let $YIELD_{it}$ denote the yield rate on the last trading day of month t of the i_{th} bond, which should be tested for the existence of a unit root. Panel B of Table 4 presents the p -values from the Levin, Lin, and Chu (LLC) test, the Im, Pesaran, and Shin (IPS) test, and several other major unit root tests for the panel. Whether the specification assumes a common unit root process or individual process, all of the test results reveal that the yield follows an $I(0)$ process if we include both the intercept and the time-trend term as independent variables.⁴ Overall, Table 4 suggests that both yields of bonds and the government bond index have stationarity. It follows that the spread between the yield of a bond and the market index includes no unit root, implying that we may regress the yield spread defined in Equation 1 on a series of independent factors that are expected to affect the spread.

Regression analysis

This subsection performs a regression analysis to explain the yield spread by monthly dummies, credit qualities, maturity, and other factors associated with the spread. First, I run the following regression equation, where the level of the yield spread is the dependent variable:

$$SPREAD_{it} = \alpha + \sum_{k=2}^{12} \beta_{0k} k_{it} MONTHLY_DUMMY_t + \beta_1 AMOUNT_i + \beta_2 TOTAL_t + \beta_3 DUMMY95-97_t \times TOTAL_t + \gamma MATURITY_{it} + \sum_k \delta_k k_{it} RATING_DUMMY_i + \varepsilon_{it} \quad (3)$$

In Equation 3, $SPREAD$ represents the yield spread between the yield rate of a bond on the last trading day of each month and the Nikkei government bond index on the day defined. Among the independent variables, $k_{it}MONTHLY_DUMMY$ is a monthly dummy variable that equals one for the kth month and zero otherwise, $AMOUNT$ is the issue size of the i_{th} bond, $TOTAL$ is the aggregated stock of corporate bonds held by investors, as reported by the Flow of Funds Accounts, $MATURITY$ is the number of days to the maturity date, and $k_{it}RATING_DUMMY$ is a dummy variable that equals one for the kth credit rating and zero otherwise. Because the range of investors who hold corporate bonds captured by the Flow of Funds Accounts varies slightly before 1997 and after 1998, I include $DUMMY95-97$, which is defined as a dummy that equals one for observations from 1995 to 1997 and zero otherwise. The base group of the monthly dummy is January, and the base of the credit

³ The null hypothesis remains rejected even if the time trend term, $TIME_t$, is excluded from Equation 2.

⁴ Moreover, both the LLC and the IPS tests rejected the null hypothesis even if the time trend variable is excluded.

dummy is an AAA rating by R&I.

Among these independent variables, maturity and credit ratings will naturally have influences on yield spreads. However, to run a regression for the prediction of debt yields, one generally faces the difficulty of handling the credit rating when it is included as an independent qualitative variable. The data set contains a total of six credit rating agencies, which assign ratings to companies before bond issuance over the sample period. The agencies include two US companies, Moody's and Standard and Poor's (S&P), and four Japanese companies, R&I, the Japan Credit Rating Agency (JCR), the Japan Bond Research Institute (JBRI), and Nippon Investors' Service (NIS).⁵ Not surprisingly, some firms obtain credit ratings from multiple agencies, whereas others receive a rating from a sole agency. Given that the purpose of this paper is to examine the monthly anomalies in the bond market and not to compare the coefficients quantitatively on each rating dummy, I take the following procedure so as to utilize as many bonds as possible in the sample. In the first place, if a firm takes a credit rating by R&I, I use the R&I rating to make a series of dummy variables of the ratings, $k_{it}RATING_DUMMY$. If the rating of the firm is not provided by R&I but by Moody's, I employ the Moody's rating to make the dummy series. Likewise, I make rating dummies of JCR, S&P, JBRI, and NIS, in that order, because Table 3 demonstrates that the number of companies receiving the rating from each agency follows the same order, with the largest number of ratings from R&I and the smallest from NIS. This procedure revealed that most of the issuers of sample bonds obtained a credit rating from R&I, Moody's, or JCR.

Other factors that potentially influence the yield spread include the total amount of bonds held by investors and the liquidity of each bond. Because an increased supply of funds for the market will exert downward pressure on the yield of straight bonds, the right-hand side of Equation 3 includes *TOTAL*. In addition, I use the issue amount of a bond, *AMOUNT*, as the proxy for the liquidity of the bond in the regression because a bond with a larger issue amount has a larger number of debentures, making it easier for investors to trade such a bond in the aftermarket.

Table 5 contains the regression results following Equation 3. Column (A) presents the results using all observed bonds as the sample, whereas column (B) presents the results for a sample of bonds with ratings above BB-. The results show that *SPREAD* is inversely and significantly related to both *TOTAL* and $DUMMY95-97 \times TOTAL$, implying that debt prices rise when the supply of funds into the market increases. In addition, maturity exhibits a positive sign, as predicted.

[Table 5]

Column (B) suggests that the level of the yield spread for the above BB- sample decreases as the issue amount, *AMOUNT*, increases, which may imply that the spread reflects a liquidity premium. Whereas the result for the full sample in column (A), comprising 129,485 observations, indicates that the coefficient on *AMOUNT* is insignificant, the estimated coefficient from the above BB- subsample, which includes 126,097

⁵ JCR and NIS merged in April 1998 to become R&I.

observations, takes a significant negative value. Because the BB– subsample excludes only 3,388 observations from the full sample, we may infer that highly risky bonds rated below B have a strong influence on the full sample estimation result. Indeed, Table 1 demonstrates that the highest spread of a bond with a B rating even rose above 100%. A possible explanation for why the statistical significance of *AMOUNT* varies between the whole sample and the higher-ratings subsample is that potential investors clearly distinguish between the investment grade market and the speculative grade market. Furthermore, as the issue size of a speculative grade debt increases, investors may acknowledge that the bond becomes riskier because the company becomes more highly leveraged through the bond issuance, which would mean that the issue amount no longer works as a proxy for the liquidity of speculative bonds.

Next, we proceed to interpret the estimation results where the dependent variable represents the monthly differences in the yield spread. To examine coefficients on the monthly dummy variables quantitatively, we replace the dependent variable in Equation 3 by $\Delta SPREAD$, defined as the one-month difference of the yield spread, as follows:

$$\begin{aligned} \Delta SPREAD_{it} = & \alpha + \sum_{k=2}^{12} \beta_{0k} k_{it} MONTHLY_DUMMY_t + \beta_1 AMOUNT_t + \beta_2 TOTAL_t \\ & + \beta_3 DUMMY95-97_t \times TOTAL_t + \gamma MATURITY_{it} + \sum_k \delta_k k_{it} RATING_DUMMY_t + \varepsilon_{it} \end{aligned} \quad (4)$$

Table 6 presents the estimation results, where the monthly difference of the yield spread is regressed on the independent variables. Similarly to Table 5, column (A) shows the results from all the bonds, whereas column (B) shows the results from bonds rated above BB–. Estimated coefficients for the monthly dummies demonstrate that the spread declined significantly from April to August, whereas it rose significantly from September to December, if we regard January as the base group of the monthly dummy, as in Equation 4. Thus, the yield rate of bonds grows toward the end of the calendar year. During the first quarter of a year, from January to March, the spread almost goes sideways. The hypotheses described earlier suggest that yields of corporate bonds will rise in December and March, and fall in January and April, because investors' fiscal year-ends are concentrated either in December or in March. The seasonality detected from the data set is consistent with the hypotheses of tax-loss selling and window dressing because the spread gradually decreases from April toward the middle of the year and increases as December approaches, although the spread does not exhibit a decrease in January nor an increase in March.

[Table 6]

Relationship between the seasonality and credit rating

Because the existing literature investigates the relationship between seasonality and ratings, this subsection estimates regressions for the yield spread by credit rating category in order to explore this relationship. Table 7 displays the estimated coefficients based on separate estimations of Equation 4 according to credit ratings, without rating dummy

variables. However, it is difficult to interpret the estimated figures as presented in Table 7, partly because the January dummy is dropped as the base group in the specification. Hence, I calculate the monthly differences of a representative bond by credit quality using Equation 5 to predict the spread difference:

$$\begin{aligned} \Delta SPREAD_t = & \hat{\alpha} + \sum_k \hat{\beta}_{0k} k_{th} MONTHLY_DUMMY_t \\ & + \hat{\beta}_1 \overline{AMOUNT} + \hat{\beta}_2 \overline{TOTAL} + \hat{\gamma} \overline{MATURITY} \end{aligned} \quad (5)$$

[Table 7]

To predict the difference of yield of a representative bond, I use the mean of the sample for the independent variables other than the monthly dummies. That is, I use $(\overline{AMOUNT}, \overline{TOTAL}, \overline{MATURITY}) = (16.754, 66890.256, 1535.134)$, which appeared in Table

1. Moreover, the predicted coefficients $(\hat{\alpha}, \hat{\beta}_{0k}, \hat{\beta}_1, \hat{\beta}_2, \hat{\gamma})$ are substituted for the figures for each rating presented in Table 7. These substitutions enable us to predict $\Delta SPREAD_t$ for each month according to credit ratings. Likewise, I calculate $\Delta SPREAD_t$ for all the bonds in the full sample using the coefficients in column (A) of Table 6.

Based on the calculation, Panel A of Fig. 2 illustrates the predicted difference for each month, $\Delta SPREAD_t$, of a representative bond according to ratings from AAA to BBB. In addition, Panel B of the figure illustrates series of all the ratings categories in a broader scale to highlight the spreads between investment grade bonds and speculative grade bonds. Remarkably, the panels first indicate that yield spreads of bonds in all categories fall consistently from April through to August. In particular, the spreads of those bonds with poorer qualities such as A, BBB, BB, and B reduce considerably during those months. Second, the figure documents that the spreads of debts rated below BBB tend to increase from September to December. Panel B shows that spreads of bonds with BB or B soar sharply during these four months. Indeed, as shown in the figure, the spread of a representative BB bond declines by 17.2 basis points from April to August, and increases by 63.8 basis points from September to December. These tendencies found in the figure suggest that the seasonality of bonds with low ratings is pronounced. By contrast, the spread of relatively high-rating bonds such as AAA or AA moves more stably, with seasonality being much smaller than for the speculative grade bonds. These empirical findings from the Japanese corporate bond market are congruent with the seasonal patterns found for the US bond market by Chang and Pinegar (1986), Maxwell (1998), and Barnhill *et al.* (2000).

[Fig. 2]

V. Conclusion

This paper has investigated the seasonality of yields associated with the Japanese corporate bond market. Empirical analysis has revealed a consistent increase in the spread between yields of corporate bonds and the Nikkei government bond index from April to August, and a decrease from September to December. Further, the results indicate that the seasonality is more pronounced as the credit rating declines, which is consistent with the findings for the US corporate bond market (Maxwell, 1998; Barnhill *et al.*, 2000). In addition, the yield spread appears to decline as the issue size of the bond increases, which may reflect the fact that the yield incorporates a liquidity premium associated with bond. Finally, the spread tends to decrease when the total amount of outstanding corporate bonds grows, indicating that an increased flow of funds into the bond market raises prices, similarly to the equity market. Overall, the seasonal effects documented in this research are consistent with the tax-loss selling and window dressing hypotheses.

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Table 1. Descriptive statistics

	Mean	SD	Minimum	Maximum	Skewness	Kurtosis	Number of Observations
<i>SPREAD</i> (%)	0.503	2.445	-4.166	115.967	15.224	369.095	129485
Δ <i>SPREAD</i> (%)	-0.00394	0.398	-37.038	27.067	12.671	1819.402	125192
<i>AMOUNT</i> (Billion Yen)	16.754	17.079	2	200	3.396	15.502	129485
<i>TOTAL</i> (Billion Yen)	66890.256	3829.176	51077.40	71089.60	-1.656	3.031	129485
<i>MATURITY</i> (Days)	1535.134	1156.898	49	10948	2.015	7.768	129485

Definition of variables: *SPREAD*: yield spread between the yield of a bond and the Nikkei government bond index

Δ *SPREAD*: one-month difference of *SPREAD*

AMOUNT: issue size of a bond

TOTAL: aggregated stock of corporate bonds held by investors

MATURITY: number of days to the maturity date

Notes: Because Δ *SPREAD* is the one-month difference of the yield spread, the number of observations for this variable only is accordingly less than the observations for other variables.

Table 2. Correlation coefficient matrix

Panel A Coefficients for the yield spread and other variables

	<i>SPREAD</i>	<i>AMOUNT</i>	<i>TOTAL</i>	<i>MATURITY</i>
<i>SPREAD</i>	1			
<i>AMOUNT</i>	−0.064	1		
<i>TOTAL</i>	−0.056	0.052	1	
<i>MATURITY</i>	0.081	0.077	−0.116	1

Number of Observations: 129,485

Panel B Coefficients for the one-month difference of yield spread and
other variables

	$\Delta SPREAD$	<i>AMOUNT</i>	<i>TOTAL</i>	<i>MATURITY</i>
$\Delta SPREAD$	1			
<i>AMOUNT</i>	−0.005	1		
<i>TOTAL</i>	−0.029	0.052	1	
<i>MATURITY</i>	−0.012	0.076	−0.112	1

Number of Observations: 125,192

Table 3. Number of bonds by credit rating

(1) S&P

AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B-	CCC+	Total
23	7	11	119	53	134	250	227	296	147	158	39	42	1	2	1509

(2) Moody's

Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	C	Total
27	40	54	28	202	122	201	264	261	309	117	84	129	61	19	2	8	8	1936

(3) R&I

AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	C	Total
14	112	123	228	327	457	380	286	156	84	81	38	15	14	17	2	2	2	1	2339

(4) JCR

AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	Total
26	19	142	161	293	273	183	167	142	74	17	8	1	7	1	1	1514

(5) JBRI

AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	Total
33	76	79	87	46	112	77	16	24	4	1	6	6	567

(6) NIS

AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	B	Total
8	36	55	47	66	45	99	10	10	12	1	2	391

Notes: Because some companies obtain a rating from a sole credit rating agency and others obtain ratings from multiple agencies, the total number of ratings across the agencies may exceed 3813, the total number of bonds in the sample.

Table 4. Unit root test

Panel A

Nikkei government bond index (Test for the series)

Null Hypothesis: Unit root		
Exogenous variables: constant, linear trend		
	Statistic	<i>p</i> -value
Augmented Dickey-Fuller test statistic	−4.344	(0.004)

	Estimated Coefficient	<i>p</i> -value
Intercept	0.3504	(0.001)
$NIKKEI_{t-1}$	−0.1666	(0.000)
$TIME_t$	−0.002203	(0.011)

Panel B

Rate of yield of corporate bonds (Test for the panel)

Exogenous variables: individual effects, individual linear trends			
Method	Statistic	<i>p</i> -value	Number of cross sections
Null: Unit root (assumes common unit root process)			
Levin, Lin and Chu <i>t</i>	−906.71	(0.000)	3406
Breitung <i>t</i> -stat	−18.72	(0.000)	3406
Null: Unit root (assumes individual unit root process)			
Im, Pesaran and Shin W-stat	−26.27	(0.000)	3406
ADF - Fisher Chi-square	9190.71	(0.000)	3406
PP - Fisher Chi-square	7800.04	(0.000)	3406

Table 5. Regression results for yield spreadDependent variable: *SPREAD* (%)

Sample		(A) All bonds	(B) Bonds with AAA, AA, A, BBB, BB
Independent Variables	Dummy Category	Estimated p -value Coefficient	Estimated p -value Coefficient
Intercept		0.0353 (0.818)	0.2322 (0.012)
Month dummy	February	−0.0233 (0.373)	−0.0128 (0.418)
	March	−0.0142 (0.589)	−0.0049 (0.760)
	April	−0.0032 (0.905)	0.0073 (0.650)
	May	−0.0299 (0.261)	−0.0183 (0.257)
	June	−0.0648 (0.014)	−0.0591 (0.000)
	July	−0.1021 (0.000)	−0.1011 (0.000)
	August	−0.1705 (0.000)	−0.1608 (0.000)
	September	−0.0727 (0.006)	−0.0682 (0.000)
	October	−0.0317 (0.230)	−0.0423 (0.008)
	November	0.0099 (0.708)	−0.0110 (0.489)
	December	−0.0135 (0.602)	−0.0250 (0.112)
<i>AMOUNT</i>		−0.000429 (0.238)	−0.00192 (0.000)
<i>TOTAL</i>		−0.0000107 (0.000)	−0.0000138 (0.000)
<i>DUMMY95-97</i>		−0.0000181 (0.000)	−0.0000129 (0.000)
<i>×TOTAL</i>			
<i>MATURITY</i>		0.000334 (0.000)	0.000378 (0.000)
Adjusted R ²		0.364	0.332
<i>F</i> -statistic		1002.43	846.271
Number	of	129485	126097
Observations			

Notes: See Table 1 for the definitions of the quantitative variables. We use monthly and rating dummy variables, which equal to 1 for observations falling into each dummy category and 0 otherwise. Estimated coefficients on credit rating variables are not reported due to space limitations. The base (or reference) group of the monthly dummy is January, and the base of the credit dummy is an AAA rating by R&I.

Table 6. Regression results for one-month difference of yield spreadDependent variable: $\Delta SPREAD$ (%)

Sample		(A) All bonds	(B) Bonds with AAA, AA, A, BBB, BB
Independent Variables	Dummy Category	Estimated p -value Coefficient	Estimated p -value Coefficient
Intercept		0.0521 (0.092)	0.0538 (0.009)
Month dummy	February	-0.0403 (0.000)	-0.0347 (0.000)
	March	-0.0035 (0.509)	-0.0021 (0.561)
	April	-0.0571 (0.000)	-0.0537 (0.000)
	May	-0.0503 (0.000)	-0.0425 (0.000)
	June	-0.0630 (0.000)	-0.0620 (0.000)
	July	-0.0530 (0.000)	-0.0543 (0.000)
	August	-0.0255 (0.000)	-0.0246 (0.000)
	September	0.0153 (0.004)	0.0137 (0.000)
	October	0.0104 (0.050)	-0.0026 (0.461)
	November	0.0172 (0.001)	0.0116 (0.001)
	December	0.0353 (0.000)	0.0226 (0.000)
$AMOUNT$		0.000112 (0.128)	0.0000718 (0.137)
$TOTAL$		-0.000000779 (0.041)	-0.000000828 (0.001)
$DUMMY_{95-97} \times TOTAL$		0.000000190 (0.220)	0.0000000915 (0.379)
$MATURITY$		-0.000000663 (0.522)	0.00000156 (0.022)
Adjusted R^2		0.050	0.0308
F -statistic		89.89	53.369
Number of		125192	121911
Observations			

Notes: See notes of Table 5.

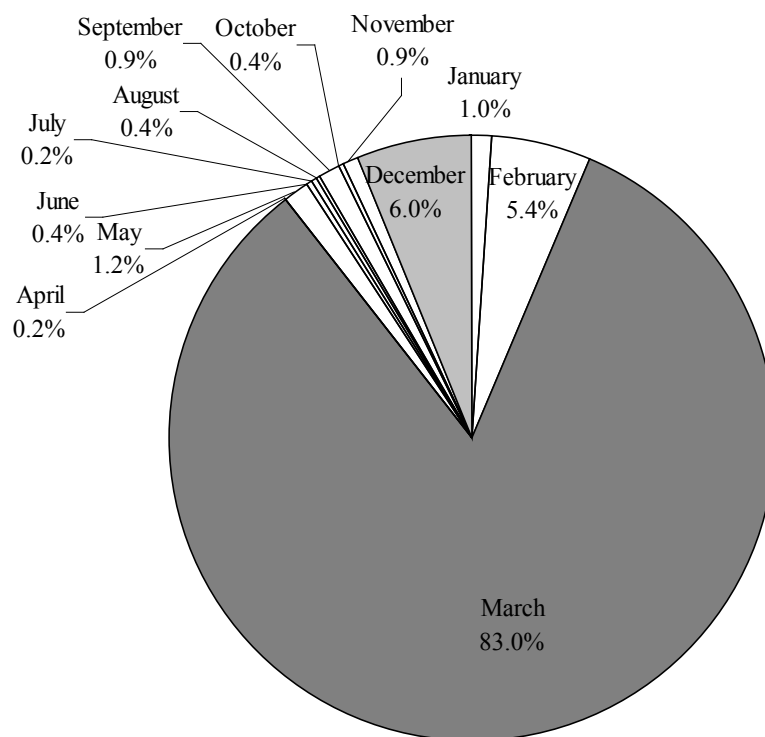
Table 7. Coefficients on monthly dummies based on separate estimations by ratings

	AAA	AA	A	BBB	BB	B
Intercept	-0.1461 (0.006)	-0.0731 (0.000)	0.0032 (0.729)	0.1809 (0.000)	0.0965 (0.522)	2.8882 (0.000)
February	0.0012 (0.889)	-0.0042 (0.116)	-0.0156 (0.000)	-0.0442 (0.000)	-0.1594 (0.000)	-0.2801 (0.087)
March	0.0107 (0.197)	0.0096 (0.000)	0.0064 (0.000)	-0.0180 (0.004)	-0.0216 (0.488)	-0.0721 (0.665)
April	-0.0033 (0.704)	-0.0046 (0.094)	-0.0376 (0.000)	-0.0732 (0.000)	-0.1665 (0.000)	-0.1902 (0.254)
May	0.0033 (0.708)	-0.0020 (0.452)	-0.0213 (0.000)	-0.0577 (0.000)	-0.1741 (0.000)	-0.3135 (0.056)
June	-0.0241 (0.006)	-0.0187 (0.000)	-0.0456 (0.000)	-0.0812 (0.000)	-0.1650 (0.000)	-0.2494 (0.127)
July	-0.0129 (0.138)	-0.0130 (0.000)	-0.0373 (0.000)	-0.0739 (0.000)	-0.1560 (0.000)	-0.1692 (0.299)
August	0.0013 (0.882)	0.0068 (0.011)	-0.0036 (0.045)	-0.0364 (0.000)	-0.1576 (0.000)	-0.2751 (0.102)
September	0.0135 (0.119)	0.0209 (0.000)	0.0176 (0.000)	0.0197 (0.002)	-0.0298 (0.348)	0.1119 (0.510)
October	-0.0013 (0.880)	0.0027 (0.316)	-0.0082 (0.000)	-0.0154 (0.013)	0.0473 (0.125)	0.5901 (0.000)
November	0.0069 (0.417)	-0.0050 (0.064)	0.0032 (0.071)	0.0119 (0.055)	0.0780 (0.011)	0.2839 (0.084)
December	-0.0082 (0.332)	0.0080 (0.003)	0.0211 (0.000)	0.0349 (0.000)	0.0248 (0.420)	0.5768 (0.000)
<i>AMOUNT</i>	-0.0000801 (0.161)	0.0000111 (0.716)	0.0000470 (0.029)	0.000185 (0.290)	0.000687 (0.276)	0.00750 (0.111)
<i>TOTAL</i>	0.00000213 (0.006)	0.000000878 (0.000)	-0.000000191 (0.156)	-0.00000274 (0.000)	0.000000393 (0.857)	-0.0000379 (0.001)
<i>DUMMY95-97</i>	NA	-	0.000000386 (0.000)	-0.00000043 (0.006)	0.000000274 (0.726)	-0.00000440 (0.231)
<i>×TOTAL</i>						
<i>MATURITY</i>	-0.00000068 (0.616)	0.000000503 (0.137)	0.000000498 (0.185)	0.00000688 (0.000)	-0.00000315 (0.778)	-0.000258 (0.000)
Number of observations	1203	19360	58808	30706	11834	2774

Notes: Coefficients on monthly dummy variables only are presented from estimations based on Equation 4 for each rating group.

Numbers in parentheses represent *p*-values.

Fig. 1. Distribution of accounting year-end months for major Japanese firms

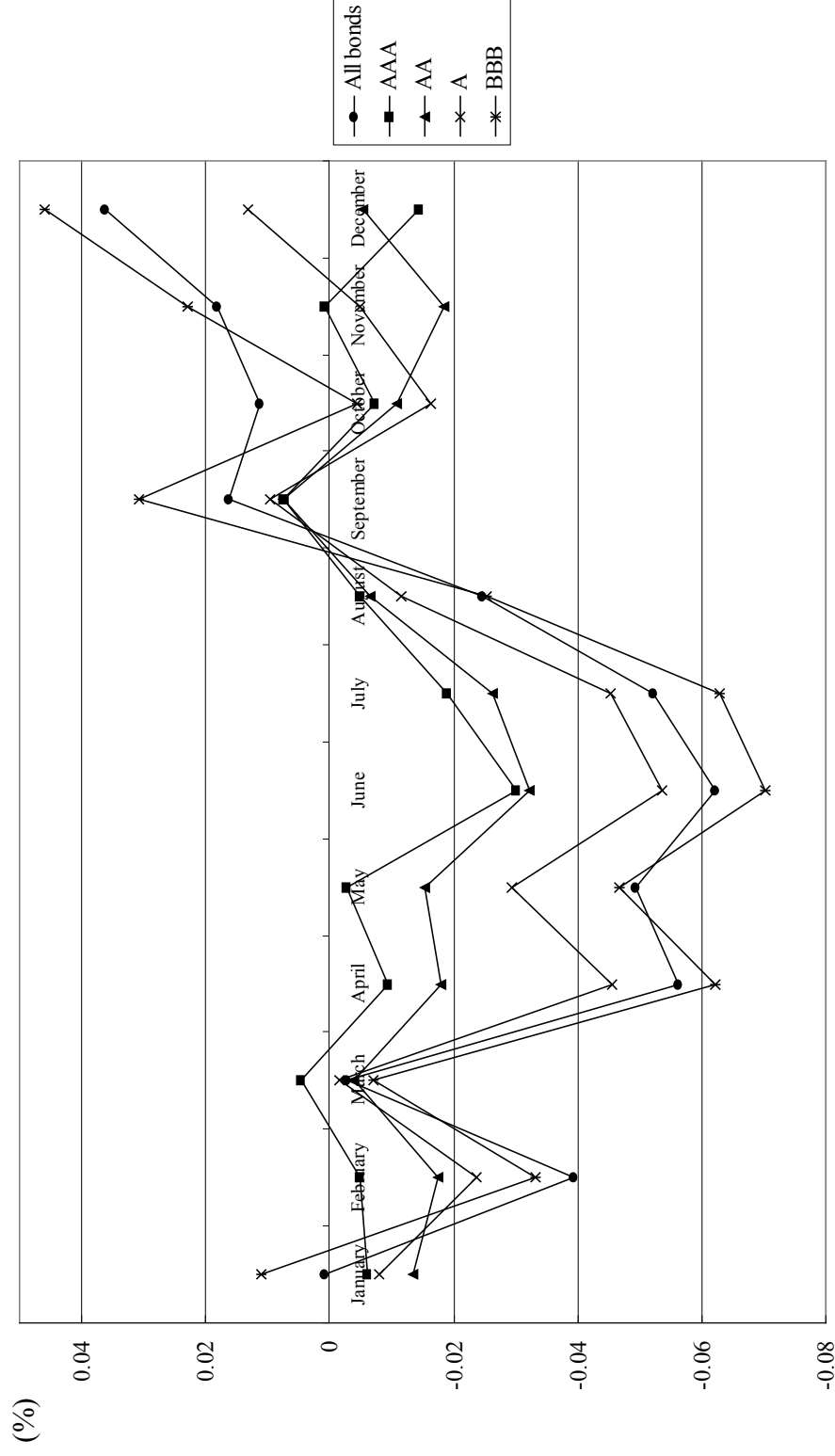


Total Number of firms: 1603

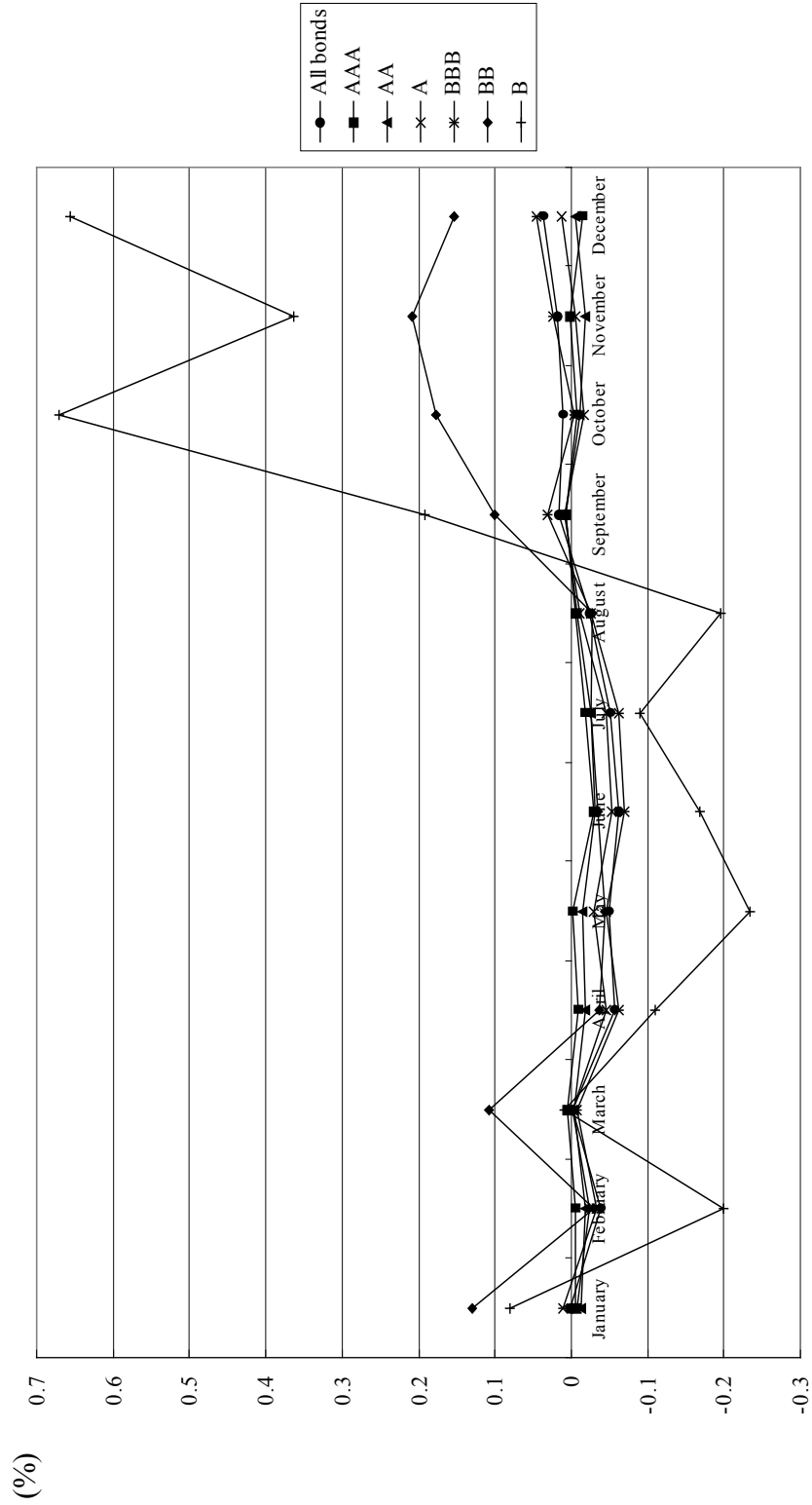
Notes: This circular chart is sourced from the homepage of 'Manabow.com' managed by Nomura Holdings, Inc. and Nikkei Digital Media, Inc.

Fig. 2. Predicted monthly differences of yield spread of a representative bond by rating

Panel A: Narrower scale



Panel B: Broader scale



Notes: The panels provide the following notable findings.

- (1) Yield spreads of bonds in all the categories consistently fall from April to August.
- (2) Spreads of all corporate bonds, and those below BB (speculative grades) increase from September to December.
- (3) Seasonality becomes more evident as the rating declines.