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Abstract

While prior studies suggest a substitutive relationship between bank monitoring with private information and stakeholders' use of public accounting information, they do not clarify the specific content of the substituted accounting information. We examine whether and how main bank monitoring with private information affects the use of accounting information by bondholders in the Japanese bond market. First, consistent with prior studies, we find that the explanatory power of accounting information is generally lower for firms with a main bank, especially when the firm's default risk is high. This suggests that the delegation of monitoring to the main bank occurs. Second, we find that bond investors of firms without a main bank place more importance on accounting information that is highly relevant to firm's debt repayment ability, such as interest and discount payments, allowance for loan losses, or cash flows from operations. This suggests that the bank monitoring with private information substitutes for these accounting items.

Keywords: bond market; financial reporting; main bank; private information; classification and regression trees; Japan

JEL classification: M41

1. Introduction

Prior studies argue that monitoring of banks who possess private information substitutes for the role of accounting information in resolving information asymmetries among stakeholders (Ali and Hwang, 2000; Ball et al., 2000; Ball and Shivakumar, 2005; Biddle and Hilary, 2006; Bharath et al. 2008; Futaesaku et al. 2023). These studies show that in the evaluation of firms that highly depend on banks, other stakeholders delegate monitoring to the bank (i.e., delegated monitoring) and thus use less firms' accounting information. While these results suggest the existence of a substitutive relationship between banks' use of private information and public accounting information, they do not clarify the specific content of the substituted accounting information. Therefore, this study examines whether and how main bank monitoring with private information affects the use of accounting information by bondholders in the Japanese bond market. Specifically, by analyzing the relationship between bond spreads and accounting information, we investigate (1) whether the main bank's monitoring of the bond-issuing firm substitutes for bondholders' use of accounting information, and (2) if it does substitute, what kind of accounting information it substitutes for.

We focus on main banks in the Japanese debt market because they are characterized by their ability to acquire private information about firms through various channels and use it for monitoring (Aoki et al., 1994; Enomoto et al., 2020; Ito and Hoshi, 2020; Futaesaku et al., 2020). Prior studies show that the delegation of monitoring by other creditors to banks with private information substitutes for accounting earnings (Biddle and Hilary, 2006; Nikolaev, 2010; Gong and Luo, 2018; Ma et al. 2019; Enomoto et al., 2020; Futaesaku et al., 2023). For example, Futaesaku et al. (2023), whose research setting is very close to ours, investigate the relationship between the bond yield spread and the quality of accounting earnings. They find that this relationship declines for bond-issuing firms with a main bank, especially when the firm's performance deteriorates. Based on this result, they interpret their findings as indicating that when the main bank has a strong incentive to monitor borrower firms, bond investors delegate the

screening role to the main bank with private information, resulting in less reliance on public information, i.e., earnings information.

However, Futaesaku et al. (2023) mainly focus on the quality of accounting accruals and do not reveal the specific details of the delegation of monitoring by bondholders. For example, it is still an open question as which accounting items bond investors use to evaluate bonds when the bond-issuing firm does not have a main bank, or which accounting items bond investors delegate to the main bank for their analysis when the bond-issuing firm has a main bank. In general, since bond investors are interested in the debt repayment capacity of the bond-issuing firm (Benston, 1969, 1973; Sunder et al., 2018), so various accounting items related to default risk should be used in the evaluation. Thus, when we investigate the substitutive relationship between private information held by the main bank and accounting information, we need to examine not only the quality of net income, but also a wide range of accounting items in the financial statements.

To address this research objective, we use a nonparametric machine learning model (Classification and Regression Trees; CART) based on Barth et al. (2023). This estimation method reduces the multicollinearity problems involved in conventional OLS estimation, allowing us to use a large number of accounting items as features and to take into account the interactions among variables. Furthermore, by calculating the importance of each accounting item, we are able to determine not only the explanatory power of the accounting items as a whole, but also the relative explanatory power of each accounting item. Using this method, we reveal (1) to what extent the delegation of monitoring to the main bank reduces the explanatory power of accounting information as a whole, and (2) which accounting items have relatively lost their explanatory power due to the substitution.

We use CART to investigate the relationship between corporate bond spreads and 26 accounting items for 4,431 observations on straight corporate bonds of Japanese firms from January 2003 to December 2022. The accounting items used in this study are selected by considering Barth et al. (2023) that investigate the value relevance of accounting information in

the stock market using CART. We also consider previous studies that investigated the usefulness of accounting information in the corporate bond market. Specifically, we use as features net income and net assets (two items) that are traditionally used in value-relevance studies; major stock items based on the balance sheet (six items); major flow items based on the income statement and cash flow statement (twelve items); non-traditional items related to intangible assets and fair value (six items); industry and year dummies.

First, as a preliminary analysis, we examine the relationship between bond spreads and accounting information using CART. While the relationship between stock price and accounting information using CART has already been examined in Barth et al. (2023), the usefulness of accounting information in the bond market has not been investigated yet. Our results of the analysis on the importance of accounting items indicate that accounting items explain more about corporate bond spreads in the following order: interest and discount expense, current liabilities, dividend payments, allowance for loan losses, net income, and net assets. This result differs from the stock market results in that accounting items related to the debt payment capacity are used more by bond investors than traditional items such as net income and net assets. We also find that CART estimates have more explanatory power than traditional OLS estimates, and that the explanatory power improves as we include more accounting items.

Second, we examine the effect of the existence of main bank on the relationship between bond spreads and accounting information. The results of our analysis generally show that the explanatory power of accounting information is lower for firms with a main bank than for firms without a main bank. Consistent with contingent governance theory of main bank (Aoki, 1994b; Futaesaku et al., 2023), such a tendency is more pronounced when firms' default risk is high.[1] This result suggests that the delegation of monitoring from bondholders to the main bank actually occurs, resulting in a decrease in the use of accounting information in the bond market. This is

[1] The detail of contingent governance theory is explained in Section 2.2.

consistent with the findings of Futaesaku et al. (2023).

Third, we examine the difference in the importance of each accounting item between firms with and without a main bank and reveal that bond investors of firms without a main bank (1) place more importance on accounting information that is highly relevant to the firms' debt repayment ability, such as interest and discount payments, allowance for loan losses, or cash flows from operations, and (2) use a relatively large combination of accounting items in evaluating bonds. These results suggest that corporate bond investors of firms that do not have a main bank use many accounting items in their evaluation, especially focusing on the firms' debt repayment ability. In other words, the results imply that these accounting items (i.e., those related to debt repayment ability) are substituted by private information held by the main bank.

The contribution of this study is twofold. First, this study develops the prior studies of the substitutive relationship between banks' private information, and accounting information by elucidating what accounting items are substituted by main bank monitoring. Prior studies provide empirical evidence suggesting that banks' private information obtained through lending relationships and other means substitute for the usefulness of accounting earnings (Biddle and Hilary, 2006; Nikolaev, 2010; Gong and Luo, 2018; Ma et al. 2019; Enomoto et al., 2020; Futaesaku et al., 2023), but it is not clear what accounting items are substituted. This study contributes to these studies by clarifying the extent to which private information from main banks substitutes for overall accounting information and which accounting items are actually substituted. These findings shed light on more specific mechanisms of delegation of monitoring to banks that have not been well elucidated.

Second, this study contributes to the studies that investigate the usefulness of accounting information in the bond market by providing new evidence based on a machine learning approach. Prior studies have investigated the usefulness of accounting information in the bond market for a limited number of accounting items (mainly, net income) by using OLS (Datta and Dhillon, 1993; Plummer and Tse, 1999; Jiang, 2008; Easton et al. 2009; DeFond and Zhang, 2014; Givoly et al.,

2017). By using CART, this study identifies the relative importance of a broader range of accounting items. Specifically, we show that items related to debt repayment capacity, such as interest and discount expense, explain more about the bond spread than net income.

This paper is organized as follows. Section 2 summarizes previous studies. Section 3 describes the research design. Section 4 presents the sample composition and descriptive statistics. Section 5 and Section 6 describe the results of the analysis and the results of the additional validation, respectively. Finally, Section 7 summarizes the results of this study and discusses its limitations.

2. Previous Studies

2.1 Usefulness of Accounting Information

2.1.1 Usefulness of accounting information in the corporate bond market

Prior studies have shown that accounting information is useful to investors in the corporate bond market (Datta and Dhillon, 1993; Plummer and Tse, 1999; Jiang, 2008; Easton et al. 2009; DeFond and Zhang, 2014; Givoly et al., 2017). For example, Datta and Dhillon (1993) show a positive correlation between unexpected earnings and abnormal returns on corporate bonds. Jiang (2008) finds that meeting earnings benchmarks, such as avoiding losses, reduces corporate bond yields and increases the likelihood of a rating upgrade. DeFond and Zhang (2014) find that the response to earnings information is smaller in the corporate bond market than in the stock market, and that the corporate bond market reacts more strongly to bad news. In a more recent study, Givoly et al. (2017) show the increasing association of accounting information with corporate bond spreads (and returns) in the United States from 1975 to 2013. These results suggest that corporate bond investors use accounting information to evaluate bonds.

Moreover, since creditors, unlike shareholders, have only fixed claims on firms, the importance of accounting information is expected to increase as firms' default risk increases. Plummer and Tse (1999) find that the relationship between stock returns and earnings is weaker

for firms with low credit ratings and that report losses, while the relationship between corporate bond returns and earnings is stronger. Easton et al. (2009) also report that the correlation between corporate bond returns and accounting information, as well as the increase in corporate bond trade volume due to earnings announcement, are more pronounced when the firm faces high default risks or announces bad news. In addition, Jiang (2008) shows that the relationship between earnings benchmark achievement and the cost of debt is stronger for firms with higher default risk. These results collectively suggest that accounting earnings are more useful to bondholders of firms with higher default risk.

2.1.2 Value relevance studies using machine learning approaches

While previous value relevance studies typically use OLS in their analyses (e.g., Holthausen and Watts, 2001; Lev and Gu, 2016), Barth et al. (2023) extend these traditional studies by using machine learning. Barth et al. (2023) provide evidence on the value relevance of accounting information for the stock market, but does not investigate the corporate bond market. Therefore, as a preliminary test, this study investigates the usefulness of accounting information in the Japanese corporate bond market.

Barth et al. (2023) point out that there are some problems in the previous research design of analyzing the value relevance of accounting information. Specifically, they point out that in order to examine the value relevance of accounting information properly, it is necessary to (1) use comprehensive accounting items that include items other than earnings, (2) use flexible empirical models that can account for nonlinear relationships between variables and price information and interactions among variables, and (3) use out-of-sample valuation indices.

Considering these points, they use 18 comprehensive accounting items as features, including those considered important for evaluating the new economy (e.g., intangible assets, growth opportunities, and alternative performance indicators), which have not received much attention in previous studies. In addition, CART (Classification and Regression Trees), a type of

nonparametric machine learning model, is used as a model capable of capturing interactions and nonlinear relationships among variables. To measure value relevance, they estimate CART on a year-by-year basis and examine the evolution of out-of-sample coefficients of determination through 10-fold cross-validation.

In their regression analysis using 246,295 observations from 1962 to 2018, consistent with previous studies, they find a decline in the value relevance of net income. However, they also find a significant increase in the value relevance of accounting items related to the new economy and a significant increase in the value relevance of accounting information "as a whole" (combined value relevance). In addition, they present results suggesting that investors have used more accounting items in their valuations in recent years than in the past. Based on these results, they conclude that it is premature to conclude that accounting information has lost its importance, as suggested in previous studies (Lev and Zarowin, 1999; Core et al., 2003; Balachandran and Mohanram, 2011; Lev and Gu, 2016; Givoly et al., 2017).

We examine the usefulness of accounting information in the corporate bond market by applying the machine learning-based value relevance estimation model presented by Barth et al. (2023) to the Japanese corporate bond market.

2.2 Delegation of Monitoring to the Main Bank

The main bank obtains internal information about its client firms through various channels. For example, Aoki (1994b) and Aoki et al. (1994) point out that by monitoring the borrower's settlement accounts, the main bank can observe transactions and related cash flow movements, which is important private information for determining the management capacity of the borrowing firm. By intervening in the management of the firm, the main bank also has direct access to the firm's internal information. In particular, as a representative creditor, the main bank is expected to intervene in firm management and lead the restructuring or liquidation of the client firm when the firm's finances deteriorate, and to play a central role in restructuring measures such as

additional financing, removal of management, and disposal of assets (Kaplan, 1994; Kaplan and Minton, 1994; Kang and Shivdasani, 1995). Since the information-gathering capacity of funding providers other than the main bank is relatively inferior to that of the main bank, the monitoring of firms' business conditions is delegated exclusively to the main bank (Aoki, 1994a).

As the main bank's influence increases, the main bank's monitoring using private information will be strengthened. Therefore, when bond-issuing firms have a main bank, bond investors are expected to delegate monitoring of the issuing firm to the main bank and reduce their own monitoring than when they do not have a main bank. Decrease in the need of monitoring therefore results in less use of accounting information.

Previous studies have presented results suggesting that private bank information obtained through lending relationships and other means may substitute for accounting information (Biddle and Hilary, 2006; Nikolaev, 2010; Gong and Luo, 2018; Ma et al. Enomoto et al., 2020; Futaesaku et al., 2023). For example, Biddle and Hilary (2006) find that while there is a relationship between higher quality accounting information and higher investment efficiency in the United States, there is no similar relationship in Japan, where the influence of banks is relatively strong. In a related study, Enomoto et al. (2020) re-examine Biddle and Hilary's (2006) finding. They show that the quality of accounting accruals has a positive relationship with investment efficiency in Japan since 2001, when financial institutions' stockholdings began to be restricted and bank loans and affiliations declined sharply.

Nikolaev (2010) shows that the relationship between the use of financial covenants for bond issuance and the quality of accounting information (timeliness of loss recognition) weakens when firms already have bank loans at the time of bond issuance. Ma et al. (2019) find that bond spreads are lower and bond issuance is larger when the bond issuer has received a loan from a bank within one year.

Finally, Futaesaku et al. (2023), which is closely related to our study, examine the effect of monitoring by Japanese main banks with private information on the use of accounting information

in the bond market. The results show that while there is a significant relationship between the quality of accounting accruals and bond spreads when the financial condition of the bond-issuing firm with a main bank is stable, there is no such relationship when the default risk is high. They argue that this result is consistent with the contingency governance theory (Aoki, 1994b), which states that the main bank's monitoring is strengthened when the borrower's financial condition deteriorates and, therefore, the firm's control rights are transferred to the main bank. More specifically, when the main bank's monitoring incentives are stronger, the delegation of monitoring by bond investors to the main bank occurs, resulting in a lower demand for earnings quality in the bond market. This implies that delegation of monitoring to the main bank with private information substitutes the need for accounting information for bondholders when firms' default risk is high.

2.3 Information Content of Banks' Private Information

While many previous studies have presented results indicating that monitoring is delegated to main banks with private information, not many studies have shown what kind of private information main banks use. However, recent studies have shed light on the sources and specifics of private information used by banks for monitoring (Berger et al., 2017; Carrizosa and Ryan, 2017; Minnis and Sutherland, 2017; Frankel et al. 2020).

Using a dataset on loans to small commercial borrowers, Minnis and Sutherland (2017) find that banks require financial statements for half of their loans and that the requirement depends on borrower characteristics and alternative sources of information. For example, they show that the provision of corporate tax returns can be both a substitute and a complement to financial statements, depending on borrower characteristics and the degree of information asymmetry between the bank and the borrower. Carrizosa and Ryan (2017) provide evidence suggesting that lenders require their clients in loan agreements to periodically disclose two types of accounting-related private information through covenants: projected financial statements for future periods and monthly historical financial statements. In addition, Frankel et al. (2020) confirm that lenders

can obtain borrowers' private information through financial covenants that require borrowers to provide aging reports that summarize detailed information about their accounts receivable.

In contrast to these previous studies, the objective of this study is not to identify the specific content of the private information used by the main bank, but to identify the specific accounting information that the main bank's private information substitute for. These findings may be important for understanding the usefulness of accounting information.

3. Research Design

3.1 Measuring Combined Relevance

We estimate Equation (1) for measuring the combined relevance of accounting information in the corporate bond market.

$$YSpread_{it+1} = f(VAR_{it}, IND_i, YEAR_t) \quad \ldots(1)$$

$YSpread_{it+1}$ is the yield spread of straight bond for firm i in three months after the end of year t, VAR_{it} is the accounting items for firm i in year t, *IND* is a set of industry dummies based on the Nikkei medium classification industry code (Nikkei gyousyu chu-bunrui), and *YEAR* is a set of year dummies.[2] In this study, we employ CART as the base estimator, following Barth et al. (2023). The hyperparameters for CART are set to 100 trees, a maximum of 300 leaf nodes, and a minimum of 3 observations per leaf. Additionally, following Barth et al. (2023), we use bagging with a bagging fraction of 1.0.[3]

For *YSpread*, we use the average compound yield spread in the secondary market. In case

[2] We eliminate industry dummies for industries that do not include both firms with and without a main bank within the same industry. Additionally, we employ feature selection via Recursive Feature Elimination with Cross-Validation (RFECV. see Guyon et al., 2002 for the details of RFECV). Through this procedure, we eliminate 18 industry dummies.
[3] Bagging is an ensemble method that uses bootstrapping to generate multiple versions of a predictor and aggregate them into a final predictor (Breiman, 1996). In this study, consistent with Barth et al. (2023), we refer to CART when predictions are made by bagging using CART as the base estimator.

where the same firm issues multiple bonds under different conditions, we use duration-matched weighted spreads (Anderson et al., 2003, 2004; Ota and Mukai, 2021) and aggregate them into a single observation per firm-year. The specific calculation procedure is as follows.

1. Calculate the duration for all corporate bonds at the end of each month.[4]
2. Aggregate the durations to obtain one observation per firm-month by calculating the weighted average duration and average compound yield, using the amount issued as weights for each firm-month.
3. Calculate the duration for government bonds at the end of each month.
4. Calculate the duration-matched weighted spread at the end of each month by subtracting the yield of the government bond with the closest duration from the yield of the corporate bond.
5. Define $YSpread_{it+1}$ as the duration-matched weighted spread for firm i in three months after the end of t.

We select accounting items following prior research that examined the value relevance of accounting information using machine learning (Barth et al., 2023) and the relationship between accounting information and cost of debt (Sengupta, 1998; Anderson et al., 2003; Bhojraj and Sengupta, 2003; Bharath et al., 2008; Jiang, 2008; Dhaliwal et al., 2011; Florou and Kosi, 2015; Franco et al., 2016; Givoly et al., 2017; Amiraslani et al., 2022; Liu and Wu, 2023). Moreover, we include items to ensure the comprehensiveness of accounting information.

Based on the above, *VAR* includes net income, *EARN*; net assets, *BVE*; cash and cash equivalents, *CASH*; current assets, *CA*; property, plant and equipment, *PPE*; intangible assets, *INTAN*; current liabilities, *CL*; fixed liabilities, *FL*; sales revenue, *REV*; cost of sales, *COS*; selling, general and administrative expenses, *SGA*; interest and dividend income, *IDI*; interest and

[4] In calculating the duration-matched weighted spread, we exclude corporate bonds for which the bond issue information necessary for the duration calculation cannot be obtained and aggregate the remaining bonds.

discounts expenses, *IDE*; income taxes, *TAX*; sales revenue growth, *REVGR*; net income growth, *EARNGR*; cash flow from operating activities, *CFO*; cash flow from investing activities, *CFI*; cash flow from financing activities, *CFF*; dividends paid, *DIV*; other comprehensive income, *OCI*; accumulated other comprehensive income, *AOCI*; research and development expenses, *RD*; advertising expenses, *ADV*; allowance for loan losses, *ALLOW*; deferred tax assets, *DTAX*.

We group the accounting items into four categories:

1. Traditional items (*EARN*, and *BVE*)
2. Stock items (*CASH*, *CA*, *PPE*, *INTAN*, *CL*, and *FL*)
3. Flow items (*REV*, *COS*, *SGA*, *IDI*, *IDE*, *TAX*, *REVGR*, *EARNGR*, *CFO*, *CFI*, *CFF*, and *DIV*)
4. Non-traditional items (*OCI*, *AOCI*, *RD*, *ADV*, *ALLOW*, and *DTAX*)

We include *EARN* and *BVE*, which have been regarded as two traditional accounting summary measure in previous studies on the relevance of accounting information (Givoly et al., 2017; Barth et al., 2023).

We then include stock and flow items, referring to the discussion of traditional financial analysis (e.g., Palepu et al., 1999; Sakurai, 2024). Regarding stock items, we include the major components of the balance sheet. Financial ratios derived from stock items, such as cash ratio, current ratio, and tangibility, are used to assess whether the borrower possesses sufficient resources to repay its debt obligations. Regarding flow items, we include the major components of the income statement and cash flow statement. Financial ratios derived from flow items such as margin, revenue growth, and interest coverage ratio are used to evaluate the magnitude and timing of revenue and expense not directly captured by stock items. Moreover, cash flow information is expected to complement the balance sheet and income statement items by evaluating a firm's operating activities, investment management, and financial risk.

Additionally, we include accounting items that have received attention in recent research. To

capture the usefulness of fair value information in debt contracts, we include *OCI* and *AOCI* (Blankespoor et al., 2013; Bao et al., 2020). We also include *RD* and *ADV* to assess whether the focus on new economy in the stock market is reflected in the bond market (Barth et al., 2023). Furthermore, we include *ALLOW* to evaluate the collectability of debt holdings as a resource of future debt repayment (Beatty and Liao, 2014). Finally, we include *DTAX* to capture the usefulness of deferred tax accounting (Skinner, 2008). All accounting items are standardized by total assets.

For the regression analysis, we examine the results using eight sets of specifications: (1) traditional items; (2) traditional items and stock items; (3) traditional items and flow items; (4) traditional items, stock items, and flow items; (5) traditional items, stock items, flow items, and non-traditional items; (6) set (5) plus *YEAR*; (7) set (5) plus *IND*; and (8) set (5) plus *YEAR* and *IND*.

In our analysis, we define *MBank* as a binary variable set to 1 if the bank is the largest lender to the firm and is among the firm's top 30 largest shareholders, and 0 otherwise, following previous studies (Enomoto et al., 2020; Futaesaku et al., 2023).

Our combined relevance metric is the *R*-squared from Equation (1). Following Barth et al. (2023), we employ 20-fold cross validation to measure out-of-sample (*OOS*) *R*-squared. Specifically, we randomly divide the sample into 20 folds, use data from 19 folds to train Equation (1), and use the trained equation to predict the spread for the 20th fold. We repeat this 20 times. *OOS R*-squared is defined as the average of these 20 *R*-squared values (Barth et al., 2023, p.11, footnote 26) .[5]

[5] In this study, we use 20-fold cross-validation instead of the 10-fold cross-validation employed by Barth et al. (2023). This is done to facilitate the comparison of relevance and importance differences between two groups after dividing the sample based on the presence or absence of a main bank. We perform robustness tests to examine the effect of differences in the number of folds in the cross-validation in Section 6.2.3.

3.2 Relevance of Individual Accounting Items

To decompose the contribution of individual accounting items to *OOS R*-squared, we employ permutation importance. Specifically, we calculate the importance of each accounting item by comparing *OOS R*-squared obtained using the original feature with *OOS R*-squared obtained after shuffling a specific feature, using a model trained on the training data from 19 splits of a 20-fold cross-validation (Barth et al., 2023, p.8, footnote 20).

In this study, however, we modify the definition of permutation importance from Barth et al. (2023) by multiplying the permutation importance by *OOS R*-squared obtained before shuffling. This adjustment is made to facilitate the comparison of importance between two groups in subsequent analyses. For example, if the combined relevance of traditional items (net income and net assets) is 5% and the importance of net income (net assets) is 4% (1%), then the decrease in *R*-squared after randomly shuffling the net income values would be four times larger than the decrease in *R*-squared after randomly shuffling the net asset values, indicating that the importance of net income as the contribution to the combined relevance of 5% is 4%.

4. Sample and Descriptive Statistics

4.1 Sample

We obtain bond prices from "Reference Statistical Prices [Yields] for OTC Bond Transactions" published by the Japan Securities Dealers Association (JSDA). Bond issuance information is retrieved from "List of Bond Issuances" (Koushasai hakkou meigara ichiran) by JSDA. For the period from October 2003 to September 2006, we use data the "List of Bond Issuances (Monthly)" (Koushasai hakkou youkou ichiran (gekkan)), which is the predecessor of the "List of Bond Issuances". For bonds issued before October 2003, which are not covered by the List of Bond Issuances (Monthly), we obtain issuance data from the "Bond Handbook Vol. 145" (Koushasai binran dai 145 gou) by the JSDA. Data on government bonds are obtained from the "Interest Rate" by the Ministry of Finance. All other data are sourced from NEEDS Financial

Quest.

Our initial sample consists of 5,490 firm-year observations from January 2003 to December 2022, covering all Japanese listed firms with straight bonds and duration-matched weighted spread values, given that the "Reference Statistical Prices [Yields] for OTC Bond Transactions" has been disclosed since August 2, 2002. We exclude 1,057 observations which are financial institutions (banks, security companies, insurance companies, and other financial institutions). We require that firms have nonmissing net income, positive net assets, and total assets, which eliminates two observables. We set to 0 any other missing accounting item as done in Barth et al. (2023). Additionally, we winsorize all non-indicator variables at the 1st and 99th percentiles, by year, to mitigate the effect of outliers on estimation results (Givoly et al., 2017; Barth et al., 2023). Our final sample contains 4,431 firm-year observations.

4.2 Descriptive Statistics

Table 1, Panel A summarizes the annual trends of *YSpread* and *MBank*. Panel A shows that *YSpread* is at a high level (1.33-1.39%) around the financial crisis period from 2006 to 2009, and it drops to near-zero levels in the period following the introduction of the negative interest rate policy in Japan in 2016. Additionally, the proportion of firms with a main bank, which exceeds 30% until 2013, sharply declines around 2014, dropping to 12.7% in the final year of the sample period, 2022. This decline in the influence of the main bank system has been attributed to the unwinding of cross-shareholdings and the relative decrease in the importance of bank borrowing through direct finance (Ito and Hoshi, 2020).

[Insert Table 1]

Table 1, Panel B presents the descriptive statistics, and Panel C presents the Pearson and Spearman correlations. Panel C shows the Pearson (Spearman) correlation coefficients are highest

for *REV* and *COS* at 0.93 (0.92), followed by *CA* and *PPE* at -0.84 (-0.79).[6] Panel C reveals that *IDE* has the largest correlation with *YSpread*, followed by *ALLOW*, and *BVE*, 0.41, -0.31, and -0.30 (0.43, -0.36, and -0.29). These accounting items are related to the debt repayment, the collectability of repayment sources, and financial stability, suggesting that bond investors place great emphasis on items related to the likelihood of debt repayment ability.

5. Empirical Results

5.1 The Relationship between Bond Spreads and Accounting Information

Barth et al. (2023) present comprehensive findings on the usefulness of accounting information in the stock market using CART. However, the usefulness of accounting information in the bond market has not yet been investigated. Therefore, as a preliminary analysis, we investigate the usefulness of accounting information in the bond market using CART.

Table 2 summarizes the results regarding the relationship between bond spreads and accounting information in the Japanese corporate bond market. Table 2, Panel A presents the combined relevance estimated by CART for all specifications. For comparison, we also estimate the combined relevance using OLS instead of CART. *Diff.* represents the difference in *R*-squared between CART and OLS. The *t*-values are derived from two-tailed Welch *t*-test on the differences in means of the 20 statistics obtained from 20-fold cross-validation for CART and OLS.

Table 2, Panel A provides two key findings. First, for all specifications except the first set, which only includes traditional items, CART *R*-squared is significantly higher than OLS *R*-squared. This result suggests that the assertion by Barth et al. (2023) that the nonlinearities and interactions CART implicitly incorporates are critical in assessing the value relevance of

[6] In Barth et al. (2023), the correlation between sales revenue and cost of goods sold is 0.98, representing the highest correlation. Barth et al. (2023) state, "However, because CART estimation is nonparametric, any skewness in the variables' distributions does not affect our estimations" (Barth et al., 2023, p.10). Nonetheless, it should be noted that while nonparametric machine learning models are known to be less affected in estimation accuracy by highly correlated variables compared to linear regression, there are concerns that estimates of permutation importance may be influenced by correlation (Gregorutti et al., 2017).

accounting information also applies to the bond market. Second, as the number of features used increases, the *OOS R*-squared for both CART and OLS also increases. This result, consistent with Barth et al. (2023), implies the importance of using a larger number of accounting items to evaluate the relevance of accounting information.

[Insert Table 2]

Table 2, Panel B presents the importance of each accounting items. Column (1) in Panel B shows the results estimated using only traditional items. The *R*-squared indicates that traditional items explain only 4.9% of the variation in bond spreads. Notably, *BVE* (3.9%) is more important than *EARN* (1.0%) in evaluating bond spreads, contrasting with the findings of Barth et al. (2023) that analyze the relevance of accounting items in the stock market. Columns (2) to (4) show the results after adding stock items, flow items, and both as features, respectively. Incorporating stock and flow information components along with traditional items (net income and net assets) greatly improves the explanatory power of accounting information. For example, comparing columns (1) and (4), the *R*-squared increases from 4.9% to 49.5%. Column (2) reveals that among stock items, *CL* (6.1%) have the highest importance, while among flow items in column (3), *IDE* (19.8%) has the highest importance. This suggests that bond investors place a great emphasis on accounting items such as current liability and interest and discounts expenses, which are useful in estimating default risk.

Furthermore, column (5) in Panel B shows the results after adding non-traditional items as features. The *R*-squared slightly increases compared to the results in column (4), with *ALLOW* (5.9%) having high importance. The allowance for loan losses is crucial for evaluating the risk management of receivables, indicating that bond investors place strong emphasis on assessing the default risk of bond-issuing firms. However, items related to intangible assets (*RD* and *ADV*) and fair value (*OCI* and *AOCI*), which have been shown to have relatively high importance in the

recent stock market (Barth et al., 2023), are not as emphasized in the bond market. Finally, columns (6) to (8) show the results after adding industry dummy, year dummy, and both. The considerable increase in *R*-squared suggests that these variables explain most of the variation in bond spreads, with the effect of year fixed effects being particularly substantial.

To clarify the importance of each accounting item, Figure 1 presents the importance from column (8) of Table 2, Panel B in descending order, excluding *IND* and *YEAR*. Figure 1 shows that even after controlling for industry and year fixed effects, items such as *IDE* (9.8%), *CL* (2.8%), *ALLOW* (1.4%), and *DIV* (1.4%) still have high importance.

[Insert Figure 1]

It is intriguing that the items of high importance in the bond market differ from those in the stock market. Barth et al. (2023) reported that in the stock market, net income had the highest importance overall, followed by net assets. However, in the bond market, the importance of both items is relatively low. Additionally, in the recent stock market, accounting items useful for evaluating new economy firms, such as intangible assets, growth opportunities, and alternative performance measures, have great importance. In contrast, these items hold low importance in the bond market. Instead, bond spreads are primarily influenced by accounting items closely related to the debt repayment ability of issuing firms, such as current liabilities, interest and discounts expenses, dividends paid, and allowance for loan losses.

5.2 The Effect of Main Banks on the Relationship Between Bond Spreads and Accounting Information

Table 3 summarizes the result of how the delegation of monitoring to main banks affects the use of accounting information in the bond market. Specifically, we split the sample into two groups based on the presence or absence of a main bank and investigate the relationship between

accounting information and bond spreads for each group.

First, we compare the *R*-squared for firms with and without a main bank. If the *R*-squared for firms with a main bank is smaller, it suggests that accounting information is used relatively less in the pricing of bonds issued by firms with a main bank, implying that bondholders delegate monitoring to the main bank. Second, we compare the importance of each accounting item between firms with and without a main bank. If an accounting item has lower importance for firms with a main bank, it indicates that the item's usefulness has decreased due to the delegation to the main bank. This implies that the accounting item is substituted by the private information available to the main bank.

[Insert Table 3]

Table 3, Panel A presents the *R*-squared for Equation (1) for firms with and without a main bank and shows their differences. Panel A shows that the difference (*Diff.*) is negative for all specifications, indicating that the *R*-squared are higher for firms without a main bank. This suggests that the use of accounting information by bond investors is relatively low for firms with a main bank in their bond pricing, indicating delegation of monitoring to the main bank. However, *t*-values are not significant for the first specification using only traditional items, the sixth specification including year fixed effects, and the eighth specifications including all features. This suggests that the delegation of monitoring to the main bank is not strongly supported by the results of the analysis.

Table 3, Panel B presents the importance of accounting items for the eighth specification for both firms with and without a main bank. If the difference of the importance for an accounting item is significantly negative, it means that the item is used more in the evaluation of bond spreads for firms without a main bank compared to those with a main bank. Panel B reveals that the differences are significantly negative for ten accounting items, while positive for four items. This

suggests that the use of accounting information increases for firms without a main bank. The results also indicate that factors other than accounting items, specifically industry (*IND*) and year (*YEAR*), significantly influence bond spreads. Particularly, bond spreads for firms with a main bank are explained more by year fixed effects than by accounting information compared to firms without a main bank.

To further examine the impact of each accounting item on bond spreads, Figure 2 presents the differences in importance from Panel B of Table 3, sorted in ascending order, excluding *IND* and *YEAR* to focus solely on the impact of accounting items. Accounting items at the top with negative differences indicate higher relative importance in firms without a main bank. Figure 2 shows that accounting items such as *IDE* (-4.99%), *ALLOW* (-1.98%), *CFO* (-0.87%), *SGA* (-0.60%), and *DIV* (-0.57%) are at the top. This suggests that bond investors of firms without a main bank place more emphasis on accounting information related to the firm's debt repayment ability compared to those with a main bank.

[Insert Figure 2]

For instance, interest and discount expenses (*IDE*) represent the interest paid on bonds or loans from trading partners and financial institutions such as banks. Financial ratios based on this item, such as the interest coverage ratio and the sales interest expense ratio, are representative indicators used to evaluate a firm's debt repayment ability. As previously mentioned, the allowance for loan losses (*ALLOW*) is a reserve set aside to anticipate and account for potential bad debts, making it a critical indicator for assessing a firm's risk management. Cash flow from operating activities (*CFO*) is also a valuable item for evaluating default risk, as it is a cash-based measure rather than an accrual-based one. Moreover, the prominence of dividends paid (*DIV*) is intriguing. Overpayment of dividends is a classic moral hazard that increases shareholder benefits at the expense of creditors, making it a key item of interest for creditors concerned about default

risk.

Next, we investigate the amount of accounting items bond investors use when evaluating bond spreads. Following the method of Barth et al. (2023), Table 3, Panel C presents the number of relevant items based on an *R*-squared threshold. We order the items by their importance and, beginning with the item with the highest importance, add items until together they explain 80 percent, 85 percent, 90 percent, and 95 percent of combined relevance. Panel C shows that for any threshold, firms without a main bank require more items to reach the threshold. For instance, at the 95 percent threshold, firms with a main bank use six accounting items, while firms without a main bank use nine items for pricing. This suggests that bonds of firms without a main bank are priced based on relatively larger number of accounting items.

In summary, the results of this section are as follows: First, comparing the *R*-squared of firms with and without a main bank show that the *R*-squared for firms with a main bank are consistently lower. This suggests that there is a delegation of monitoring from bondholders to the main bank. However, some specifications do not show significant differences in the *R*-squared, indicating that this finding should be interpreted with caution. Second, comparing the importance of each accounting item between firms with and without a main bank reveals that bond investors for firms without a main bank (1) place greater emphasis on accounting items related to debt repayment ability, such as interest and discount expenses, allowance for loan losses, or cash flows from operating activities, and (2) determine bond prices using a relatively larger number of accounting items.

6. Additional Analysis

6.1 Contingent Governance

Prior studies have argued that a distinctive feature of main bank monitoring is “contingent governance,” where a main bank has a strong incentive to monitor and influence borrowing firms when they perform poorly (Aoki, 1994b; Futaesaku et al., 2023). In this section, we investigate

whether the findings related to the delegation of monitoring to main banks, as observed in the previous sections, become more pronounced when the bond-issuing firms perform poorly, consistent with the contingent governance theory. Specifically, we examine whether the substitution of accounting information through the delegation of monitoring is more pronounced in firms with relatively high default risk by splitting the sample annually based on Ohlson's (1980) O-score. Firms with an O-score above the first quartile in each year are defined as the high default risk group, while the others are categorized as the non-high default risk group.

First, we examine whether the difference in *R*-squared between firms with and without a main bank varies according to default risk. Table 4, Panel A presents the results for the high default risk group, whereas Panel B shows the results for the non-high default risk group. Panel A indicates that, the *R*-squared for firms without a main bank are significantly larger, except for the first specification using only traditional items. Furthermore, compared to Panel A of Table 3, the differences between the two groups are more pronounced. Panel B presents that no significant differences are observed for all specifications except the second set for the non-high default risk group. These overall findings suggest that the substitution of accounting information by the delegation of monitoring to main banks is more pronounced in cases of high default risk, consistent with contingent governance theory.

[Insert Table 4]

Next, we examine whether the importance of accounting items differs between firms with and without a main bank according to default risk. Table 4, Panels C and D present the importance for the eighth specification using all items, for the high default risk group and the non-high default risk group, respectively. Comparing Panel C and D shows that delegation of monitoring happens only when firms face high default risk. Panel C for the high default risk group shows that the items significantly emphasized for firms without a main bank, listed in ascending order of

difference, are *IDE* (-29.13%), *CA* (-5.83%), *PPE* (-2.33%), and *ALLOW* (-1.43%). Additionally, Panel C shows that among the high default risk group, the total importance of accounting items for firms with a main bank is 13.02%, derived by subtracting the importance of industry and year fixed effects (0.09% + 35.38%) from the total *R*-squared (48.49%). This is relatively small compared to the 52.37% (61.16% - 0.62% - 8.17%) for firms without a main bank, indicating a very small proportion of accounting items in the *R*-squared for firms with a main bank among the high default risk group. In contrast, Panel D for the non-high default risk group shows that the importance of *YEAR* is quite high regardless of the presence of a main bank (70.60% for firms with a main bank and 70.23% for those without), indicating that the difference in the proportion of accounting items used between firms with and without a main bank is observed only in the high default risk group.

In summary, the results indicate, first, that the difference in *R*-squared between firms with and without a main bank becomes more pronounced when the default risk of bond-issuing firms is high. This suggests the delegation of monitoring to main banks by bondholders occurs when firms' default risk become high, consistent with contingent governance theory. Second, the analysis of the importance reveals that the substitution of accounting information through the delegation of monitoring to main banks is observed, mainly for accounting items related to debt repayment ability. In contrast, for the non-high default risk group, the bond spreads are mostly explained by the year fixed effects, with almost no significant differences observed regardless of the presence of a main bank. This implies that the substitution of accounting information through the delegation of monitoring to main banks is only prominent during periods of poor performance, when the governance by main banks is expected to be stronger. This result is consistent with contingent governance theory.

6.2 Robustness Tests

6.2.1 Alternative machine learning model

In the main analysis, we utilize bagged CART as the estimator following Barth et al. (2023). In this section, we examine whether our results remain consistent regardless of the machine learning model employed. Specifically, we apply AdaBoost, a prominent ensemble learning model, instead of bagging.[7] We configure the model with 100 trees, a tree depth of 10, a maximum of 300 leaf nodes, a minimum of 3 observations required per leaf, and a learning rate of 0.05.

Table 5, Panel A presents a comparison of the *R*-squared for Equation (1) for firms with and without a main ban, based on AdaBoost. Panel A shows that the findings of the main analysis are robust to the change in the machine learning model from bagging to AdaBoost. Panel A confirms that there is no significant difference between the *R*-squared for firms with and without main banks for the first specification using only traditional items and the sixth to eighth specification including fixed effects. This result is consistent with the main analysis, suggesting that there is no difference in the overall use of accounting information depending on whether a firm has a main bank or not. Panel B presents the importance of all variables for firms with and without a main bank. Panel B shows that, among the items significantly important for firms without a main bank, *IDE* (-5.08%) is the most important, followed by *ALLOW* (-2.00%), *DIV* (-1.28%), and *BVE* (-0.72%), listed in order of absolute value of the difference. Furthermore, we observe that a higher percentage of the variables with significantly higher importance for firms with a main bank are explained by *YEAR* (63.42%). This suggests that, as in the main analysis, bond investors in firms without a main bank prioritize information related to debt repayment likelihood, such as interest and discount expense and allowance for loan losses, among other accounting items to determine the price, whereas bond investors in firms with a main bank set a consistent spread annually.

[Insert Table 5]

[7] AdaBoost is a form of boosting, an ensemble learning algorithm that iteratively trains and adjusts the weighting of the training data based on prediction errors, aggregating the model's prediction outcomes at each iteration to enhance accuracy. It is the first practical boosting algorithm and remains one of the most widely used, with applications across various domains (Schapire, 2013).

6.2.2 Alternative hyperparameters

For estimating Equation (1) in the main analysis, we follow prior research (Barth et al., 2023) to set the hyperparameters: 100 trees, a maximum of 300 leaf nodes, a minimum of 3 observations per leaf, and a bagging fraction of 1.0. This section assesses the robustness of the main analysis results when hyperparameters are changed within reasonable ranges. Specifically, we examine the changes in the *R*-squared and the importance of accounting items by varying the maximum number of leaf nodes to 200, 300, and 400; the minimum number of observations per leaf to 2, 3, and 4; and the bagging fraction to 0.5 and 1.0 for both the specification using only all accounting items and the specification including fixed effects.

Table 6, Panel A compares the distribution of *R*-squared when hyperparameters are changed with the *R*-squared from the main analysis for both the specification. Panel A confirms that the *R*-squared remain at the same level as in the main analysis, regardless of the presence of a main bank, even when the hyperparameters are changed.

[Insert Table 6]

Table 6, Panel B compares the average importances for the specification including all items, averaged across all hyperparameter settings, to those of the main analysis. Panel B shows that the findings of the main analysis are robust to changes in hyperparameters. Panel B indicates that, among the items emphasized for firms without a main bank, the top item by absolute difference is *IDE* (-5.87%), followed by *ALLOW* (-1.68%). These items are consistent with the main analysis, and the differences are generally at the same level. For firms with a main bank, the items with the largest absolute differences are *YEAR* (11.72%) and *EARN* (1.32%), which align with the main analysis.

6.2.3 Alternative number of folds

Finally, we assess the stability of the main analysis results when the number of folds in cross-validation is changed within a reasonable range. We examine the changes in the *R*-squared and the importance by altering the number of folds to 10, 15, 20, 25, and 30, for both the specification using only all accounting items and the specification including fixed effects.

Table 7, Panel A compares the distribution of *R*-squared when the number of folds is changed with the *R*-squared from the main analysis for both specifications. Panel A confirms that the *R*-squared remain consistent with the main analysis even when the number of folds is changed, regardless of the presence of a main bank.

[Insert Table 7]

Table 7, Panel B compares the average importances for the eighth specification including all items, averaged across all numbers of folds, to those of the main analysis. Panel B indicates that, among the items emphasized for firms without a main bank, the top item by absolute difference is *IDE* (-4.95%), followed by *ALLOW* (-1.95%) and *CFO* (-0.90%). These items are consistent with the main analysis, and the differences are generally at the same level. For firms with a main bank, the items with the largest absolute differences are *YEAR* (8.01%) and *EARN* (1.17%), which align with the main analysis, and the differences are generally at the same level.

In summary, the main analysis results are robust to changes in the number of folds.

7. Conclusion

This study examines, for the Japanese corporate bond market, (1) whether the main bank's monitoring of the bond-issuing firm substitutes for bondholders' use of accounting information, and (2) if it does substitute, what kind of accounting information it substitutes. First, in a preliminary analysis of the full sample, we examine the relationship between bond spreads and

accounting information using CART. We find that the relationship between bond spreads and accounting items is stronger in the following order: interest and discount expense, current liabilities, dividend payments, allowance for loan losses, net income, and net assets.

Second, comparing firms with and without a main bank, we find that the explanatory power of accounting information is generally lower for firms with a main bank, and this tendency is more pronounced when the firm's default risk is high. This result suggests that there is a delegation of monitoring from bondholders to the main bank.

Third, we examine the difference in the importance of each accounting item between firms with and without a main bank and show that bond investors of firms without a main bank (1) place more importance on accounting information that is highly relevant to the firm's ability to repay debt, such as interest and discount payments, allowance for loan losses, or cash flows from operations, and (2) use a relatively large combination of accounting items in evaluating bonds. These results suggest that corporate bond investors of firms without a main bank use many accounting items in their evaluation, especially focusing on the firm's debt repayment ability. That is, these accounting items (i.e., those related to debt repayment ability) are substituted by the main bank monitoring with private information.

The first limitation of this study is that there are many variations in the identification of models to test for value relevance, and the choice of model may affect the results. In this study, a number of robustness tests are performed to address this concern, but they may not be sufficient. Second, it should be noted that, as pointed out in previous studies, the associations elucidated in this study are merely correlations, and the implications obtained will be limited (Holthausen and Watts, 2001). Although this study confirms the effect of the main bank on the usefulness of accounting information, a more detailed examination is needed to determine whether this relationship is causal.

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Table 1. Descriptive Statistics

Panel A. Annual Trend in Key Variables

YEAR	Mean *Yspread*	Obs. *Yspread*	*MBank*=1	*MBank*=0	Percentage of firms with a main bank
2003	0.42%	99	36	63	36.4%
2004	1.01%	130	44	86	33.8%
2005	0.43%	147	55	92	37.4%
2006	1.34%	164	56	108	34.1%
2007	1.39%	175	68	107	38.9%
2008	1.35%	196	78	118	39.8%
2009	1.33%	196	81	115	41.3%
2010	0.57%	199	72	127	36.2%
2011	0.49%	211	76	135	36.0%
2012	0.43%	236	82	154	34.7%
2013	0.43%	245	79	166	32.2%
2014	0.21%	243	59	184	24.3%
2015	0.15%	241	40	201	16.6%
2016	-0.02%	238	43	195	18.1%
2017	0.04%	249	43	206	17.3%
2018	0.00%	263	41	222	15.6%
2019	-0.08%	274	45	229	16.4%
2020	0.07%	293	47	246	16.0%
2021	0.05%	309	47	262	15.2%
2022	0.22%	323	41	282	12.7%
All	0.49%	4,431	1,133	3,298	25.6%

Panel B. Descriptive Statistics

	count	mean	std	min	25%	median	75%	max
YSpread	4,431	0.004	0.006	-0.008	0.000	0.002	0.006	0.059
EARN	4,431	0.026	0.028	-0.168	0.012	0.025	0.040	0.122
BVE	4,431	0.409	0.151	0.065	0.289	0.400	0.524	0.805
CASH	4,431	0.104	0.077	0.004	0.046	0.085	0.139	0.450
CA	4,431	0.416	0.172	0.031	0.296	0.438	0.538	0.858
PPE	4,431	0.383	0.200	0.020	0.230	0.347	0.504	0.927
INTAN	4,431	0.047	0.075	0.000	0.009	0.018	0.047	0.609
CL	4,431	0.299	0.113	0.062	0.215	0.288	0.367	0.729
FL	4,431	0.291	0.144	0.021	0.183	0.259	0.367	0.779
REV	4,431	0.824	0.362	0.100	0.586	0.801	1.004	2.952
COS	4,431	0.619	0.322	0.000	0.411	0.586	0.768	2.798
SGA	4,431	0.151	0.113	0.000	0.073	0.127	0.204	0.827
IDI	4,431	0.002	0.002	0.000	0.001	0.002	0.003	0.018
IDE	4,431	0.004	0.004	0.000	0.002	0.003	0.006	0.037
TAX	4,431	0.015	0.011	-0.031	0.009	0.014	0.021	0.064
REVGR	4,431	0.018	0.100	-1.669	-0.018	0.017	0.063	0.549
EARNGR	4,431	0.002	0.027	-0.210	-0.006	0.002	0.011	0.195
CFO	4,431	0.066	0.037	-0.130	0.043	0.065	0.088	0.270
CFI	4,431	-0.052	0.037	-0.328	-0.069	-0.047	-0.029	0.059
CFF	4,431	-0.009	0.042	-0.142	-0.035	-0.015	0.011	0.229
DIV	4,431	-0.009	0.006	-0.040	-0.011	-0.007	-0.005	0.000
OCI	4,431	0.003	0.022	-0.130	-0.008	0.001	0.013	0.084
AOCI	4,431	0.015	0.035	-0.127	-0.001	0.010	0.032	0.211
RD	4,431	0.017	0.022	0.000	0.001	0.009	0.026	0.132
ADV	4,431	0.006	0.014	0.000	0.000	0.000	0.004	0.102
ALLOW	4,431	-0.003	0.005	-0.056	-0.004	-0.002	-0.001	0.000
DTAX	4,431	0.009	0.029	-0.128	-0.007	0.008	0.025	0.185

Panel C. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
(1)*YSpread*		-0.25	-0.29	-0.11	0.02	0.03	-0.14	0.27	0.10	0.10	0.13	0.03	0.06	0.43	-0.03	0.04	-0.01	-0.11	0.05	0.02	0.33	-0.03	-0.19	0.00	0.06	-0.36	0.14
(2)*EARN*	-0.24		0.51	0.25	0.22	-0.24	0.14	-0.10	-0.43	0.18	0.05	0.19	0.09	-0.40	0.66	0.35	0.42	0.45	-0.13	-0.24	-0.58	0.08	0.14	0.17	0.06	0.10	-0.11
(3)*BVE*	-0.30	0.45		0.46	0.28	-0.24	0.17	-0.37	-0.72	0.17	0.05	0.33	0.22	-0.66	0.43	0.06	0.04	0.35	-0.15	-0.14	-0.69	0.08	0.15	0.37	0.11	0.15	-0.12
(4)*CASH*	-0.10	0.22	0.45		0.56	-0.51	0.21	-0.04	-0.46	0.16	0.08	0.23	0.18	-0.46	0.24	0.05	0.07	0.14	0.06	0.01	-0.32	0.04	-0.07	0.26	0.15	0.02	0.04
(5)*CA*	0.01	0.18	0.29	0.54		-0.79	0.10	0.50	-0.65	0.51	0.46	0.37	0.31	-0.39	0.24	0.13	0.08	-0.05	0.23	-0.04	-0.25	0.03	-0.08	0.49	0.16	-0.29	0.14
(6)*PPE*	0.00	-0.20	-0.29	-0.47	-0.84		-0.37	-0.42	0.52	-0.36	-0.26	-0.38	-0.36	0.39	-0.22	-0.13	-0.08	0.07	-0.25	0.06	0.27	-0.06	0.01	-0.42	-0.21	0.24	-0.01
(7)*INTAN*	-0.10	0.13	0.12	0.11	0.01	-0.35		0.01	-0.10	0.13	-0.05	0.45	0.01	-0.14	0.18	0.06	0.01	0.12	-0.05	-0.08	-0.24	0.02	-0.09	0.16	0.22	-0.03	-0.04
(8)*CL*	0.28	-0.14	-0.41	-0.08	0.52	-0.45	-0.06		-0.27	0.55	0.58	0.24	0.19	0.05	0.02	0.12	0.03	-0.17	0.19	0.00	0.22	-0.03	-0.11	0.21	0.04	-0.43	0.11
(9)*FL*	0.09	-0.36	-0.71	-0.41	-0.71	0.65	-0.08	-0.34		-0.49	-0.39	-0.40	-0.30	0.65	-0.42	-0.13	-0.05	-0.20	-0.03	0.15	0.53	-0.06	-0.09	-0.49	-0.11	0.12	0.01
(10)*REV*	0.10	0.11	0.11	0.08	0.50	-0.41	-0.01	0.51	-0.50		0.92	0.58	0.28	-0.19	0.33	0.21	0.05	0.14	0.00	-0.11	-0.17	-0.06	-0.12	0.33	0.15	-0.32	0.14
(11)*COS*	0.11	-0.01	-0.02	-0.01	0.44	-0.31	-0.16	0.53	-0.39	0.93		0.31	0.33	-0.13	0.18	0.17	0.02	0.02	0.04	-0.04	-0.02	-0.05	-0.06	0.24	-0.01	-0.27	0.08
(12)*SGA*	0.04	0.11	0.25	0.19	0.30	-0.35	0.30	0.15	-0.37	0.51	0.20		0.10	-0.22	0.31	0.07	0.04	0.24	-0.07	-0.14	-0.30	-0.03	-0.17	0.45	0.41	-0.30	0.17
(13)*IDI*	0.07	0.01	0.11	0.06	0.19	-0.33	-0.10	0.11	-0.20	0.13	0.18	-0.03		-0.13	0.09	0.05	-0.02	-0.06	0.07	-0.01	-0.14	-0.06	0.20	0.19	-0.01	-0.19	-0.19
(14)*IDE*	0.41	-0.29	-0.60	-0.36	-0.42	0.44	-0.08	-0.02	0.64	-0.21	-0.14	-0.21	-0.07		-0.29	-0.08	-0.04	-0.11	0.03	-0.01	0.51	-0.11	-0.22	-0.24	-0.15	-0.15	0.14
(15)*TAX*	0.01	0.54	0.39	0.23	0.22	-0.22	0.15	-0.01	-0.39	0.26	0.11	0.27	0.04	-0.22		0.30	0.19	0.42	-0.17	-0.17	-0.48	0.00	0.03	0.20	0.12	-0.03	-0.01
(16)*REVGR*	0.00	0.37	0.03	0.00	0.09	-0.10	0.05	0.08	-0.10	0.18	0.15	0.05	0.01	-0.06	0.24		0.35	0.07	-0.05	0.00	-0.06	0.13	0.17	0.02	0.02	-0.05	-0.08
(17)*EARNGR*	-0.08	0.52	0.02	0.05	0.05	-0.05	-0.01	0.00	-0.03	0.01	-0.01	0.00	-0.05	-0.02	0.10	0.33		0.19	0.11	-0.22	0.07	0.21	0.10	0.03	0.03	-0.04	-0.03
(18)*CFO*	-0.14	0.46	0.35	0.18	-0.05	0.05	0.16	-0.21	-0.20	0.10	-0.03	0.21	-0.08	-0.08	0.43	0.05	0.18		-0.34	-0.42	-0.37	-0.01	-0.11	0.25	0.03	0.09	0.14
(19)*CFI*	0.03	-0.10	-0.14	0.06	0.20	-0.16	-0.12	0.20	-0.02	0.03	0.08	-0.07	0.08	0.05	-0.17	-0.06	0.13	-0.31		-0.39	0.20	0.09	0.11	-0.11	0.03	-0.13	-0.06
(20)*CFF*	0.08	-0.26	-0.14	0.01	-0.04	0.03	-0.03	-0.01	0.15	-0.11	-0.05	-0.10	-0.01	-0.03	-0.15	0.01	-0.22	-0.40	-0.50		0.12	-0.07	-0.03	-0.13	-0.04	0.04	-0.09
(21)*DIV*	0.25	-0.50	-0.60	-0.36	-0.24	0.29	-0.32	0.22	0.45	-0.08	0.08	-0.25	-0.03	0.38	-0.46	-0.02	0.09	-0.37	0.15	0.15		0.06	-0.03	-0.30	-0.10	-0.18	0.02
(22)*OCI*	-0.10	0.10	0.09	0.05	0.02	-0.06	0.03	-0.05	-0.05	-0.07	-0.07	-0.04	-0.10	-0.12	0.00	0.14	0.22	-0.02	0.10	-0.09	0.06		0.36	0.02	-0.02	0.02	-0.15
(23)*AOCI*	-0.14	0.12	0.15	-0.06	-0.10	0.01	-0.09	-0.12	-0.07	-0.14	-0.08	-0.18	0.19	-0.20	0.01	0.15	0.08	-0.11	0.11	-0.04	0.04	0.37		-0.12	-0.16	0.16	-0.41
(24)*RD*	0.02	0.05	0.29	0.31	0.41	-0.40	0.19	0.12	-0.39	0.18	0.06	0.33	0.03	-0.20	0.14	-0.05	-0.02	0.17	-0.04	-0.10	-0.26	-0.02	-0.15		0.13	-0.13	0.22
(25)*ADV*	0.01	0.08	0.14	0.20	0.14	-0.19	0.22	0.02	-0.16	0.20	0.01	0.55	-0.03	-0.13	0.13	0.02	0.00	0.09	0.00	-0.06	-0.19	-0.04	-0.17	0.17		-0.13	0.07
(26)*ALLOW*	-0.31	0.12	0.20	0.01	-0.25	0.25	0.04	-0.39	0.09	-0.22	-0.19	-0.17	-0.17	-0.15	-0.01	0.01	-0.01	0.12	-0.16	0.03	-0.16	0.04	0.16	0.00	-0.07		-0.14
(27)*DTAX*	0.09	-0.07	-0.10	0.10	0.17	-0.04	-0.05	0.16	-0.01	0.16	0.09	0.22	-0.20	0.12	-0.01	-0.07	-0.02	0.14	-0.04	-0.08	-0.03	-0.15	-0.40	0.30	0.10	-0.14	

Note: Table 1 presents descriptive statistics for 4,431 observations on straight corporate bonds of Japanese firms from January 2003 to December 2022. Panel A presents the annual trends in the main variables. Panel B presents descriptive statistics. and Panel C presents the Pearson (Spearman) correlations in the lower right (upper left).

Table 2. The Relationship Between Bond Spreads and Accounting Information

Panel A. Combined Relevance

	CART	OLS	*Diff.*	*t-value*	
(1)	4.9%	8.9%	-4.0%	-1.923	*
(2)	33.0%	12.7%	20.3%	12.253	***
(3)	43.0%	26.6%	16.4%	7.180	***
(4)	49.5%	32.4%	17.0%	7.877	***
(5)	53.1%	34.0%	19.1%	9.007	***
(6)	76.0%	69.6%	6.4%	2.732	***
(7)	54.0%	36.0%	18.0%	8.533	***
(8)	76.3%	70.9%	5.4%	2.303	**

Panel B. Importance of Individual Accounting Items

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EARN	1.0%	2.8%	1.2%	1.2%	0.8%	0.4%	0.8%	0.5%
BVE	3.9%	10.7%	2.8%	0.8%	0.7%	0.5%	0.6%	0.4%
CASH	-	1.8%	-	0.7%	0.6%	0.4%	0.5%	0.3%
CA	-	3.3%	-	0.7%	0.6%	0.4%	0.5%	0.2%
PPE	-	3.5%	-	1.4%	0.9%	0.5%	0.8%	0.4%
INTAN	-	4.0%	-	2.1%	2.4%	0.1%	2.4%	0.1%
CL	-	6.1%	-	7.3%	3.8%	2.8%	3.8%	2.8%
FL	-	0.8%	-	0.7%	0.7%	0.1%	0.7%	0.1%
REV	-	-	2.6%	0.4%	0.2%	0.1%	0.2%	0.1%
COS	-	-	2.4%	0.4%	0.7%	0.1%	0.5%	0.1%
SGA	-	-	1.4%	1.0%	0.7%	0.4%	0.6%	0.3%
IDI	-	-	1.2%	0.5%	0.5%	0.2%	0.4%	0.1%
IDE	-	-	19.8%	24.2%	25.3%	9.8%	25.7%	9.8%
TAX	-	-	5.0%	3.8%	2.5%	0.2%	2.3%	0.2%
REVGR	-	-	0.3%	0.1%	0.2%	0.0%	0.2%	0.0%
EARNGR	-	-	0.5%	0.4%	0.3%	0.2%	0.3%	0.1%
CFO	-	-	1.1%	0.5%	0.7%	0.4%	0.7%	0.4%
CFI	-	-	0.6%	0.4%	0.4%	0.2%	0.4%	0.2%
CFF	-	-	0.6%	0.7%	0.7%	0.3%	0.7%	0.3%
DIV	-	-	3.6%	2.2%	1.4%	1.5%	1.5%	1.4%
OCI	-	-	-	-	0.7%	0.2%	0.7%	0.2%
AOCI	-	-	-	-	1.0%	0.2%	1.0%	0.2%
RD	-	-	-	-	0.5%	0.1%	0.5%	0.1%
ADV	-	-	-	-	0.6%	0.0%	0.6%	0.0%
ALLOW	-	-	-	-	5.9%	1.4%	6.0%	1.4%
DTAX	-	-	-	-	0.5%	0.1%	0.5%	0.1%
IND	-	-	-	-	-	-	1.2%	0.6%
YEAR	-	-	-	-	-	55.5%	-	55.7%
R-squared	4.9%	33.0%	43.0%	49.5%	53.1%	76.0%	54.0%	76.3%

Note: Table 2 presents the relationship between bond spreads and accounting information. Panel A compares CART *R*-squared with OLS *R*-squared. We conduct the analysis using eight sets of specifications: (1) traditional items only; (2) traditional items and stock items; (3) traditional items and flow items; (4) traditional items, stock items, and flow items; (5) traditional items, stock items, flow items, and non-traditional items; (6) set (5) plus *YEAR*; (7) set (5) plus *IND*; and (8) set (5) plus *YEAR* and *IND*. Panel B presents the importance of CART *R*-squared in Panel A. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Table 3. The Effect of Main Banks on the Relationship Between Bond Spreads and Accounting Information

Panel A. Combined Relevance

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
(1)	-2.6%	3.4%	-6.0%	-1.309	
(2)	22.0%	34.1%	-12.2%	-4.358	***
(3)	34.6%	43.9%	-9.3%	-2.748	**
(4)	40.4%	50.8%	-10.4%	-3.420	***
(5)	44.8%	53.7%	-8.8%	-2.902	***
(6)	73.2%	74.7%	-1.5%	-0.487	
(7)	45.2%	54.3%	-9.1%	-3.028	***
(8)	73.5%	75.0%	-1.6%	-0.491	

Panel B. Importance of Individual Accounting Items

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
EARN	1.38%	0.24%	1.14%	4.660	***
BVE	0.52%	1.00%	-0.48%	-1.973	*
CASH	0.20%	0.23%	-0.03%	-0.292	
CA	0.66%	0.27%	0.39%	2.907	***
PPE	0.24%	0.73%	-0.50%	-5.186	***
INTAN	0.14%	0.18%	-0.04%	-0.846	
CL	2.11%	2.03%	0.08%	0.144	
FL	0.21%	0.11%	0.10%	1.769	*
REV	0.05%	0.16%	-0.11%	-1.478	
COS	0.03%	0.15%	-0.12%	-2.476	**
SGA	0.00%	0.60%	-0.60%	-2.650	**
IDI	0.11%	0.16%	-0.05%	-0.776	
IDE	5.31%	10.30%	-4.99%	-4.262	***
TAX	0.25%	0.13%	0.12%	1.401	
REVGR	0.01%	0.07%	-0.06%	-1.339	
EARNGR	0.09%	0.13%	-0.03%	-0.288	
CFO	0.08%	0.95%	-0.87%	-2.653	**
CFI	0.22%	0.17%	0.05%	0.376	
CFF	0.10%	0.23%	-0.14%	-1.769	*
DIV	1.23%	1.81%	-0.57%	-1.704	*
OCI	0.13%	0.13%	0.00%	0.055	
AOCI	0.19%	0.23%	-0.04%	-0.425	
RD	0.23%	0.20%	0.03%	0.295	
ADV	0.04%	0.05%	-0.02%	-0.562	
ALLOW	0.17%	2.15%	-1.98%	-7.413	***
DTAX	0.21%	0.14%	0.08%	1.045	
IND	0.25%	0.91%	-0.66%	-7.098	***
YEAR	59.31%	51.56%	7.75%	3.831	***
R-squared	73.47%	75.03%	-1.57%	-0.491	

Panel C. Number of Relevant Accounting Items

Threshold	*MBank*=1	*MBank*=0	
80%	1	2	
85%	2	3	
90%	3	5	
95%	6	9	

Note: Table 3 presents the result of how the delegation of monitoring to main banks affects the use of accounting information in the bond market by dividing the sample into two groups based on the presence or absence of a main bank and investigating the relationship between accounting information and bond spreads for each group. Panel A presents the *R*-squared for Equation (1) for both firms with and without a main bank and shows their differences. We conduct the analysis using eight sets of specifications: (1) traditional items only; (2) traditional items and stock items; (3) traditional items and flow items; (4) traditional items, stock items, and flow items; (5) traditional items, stock items, flow items, and non-traditional items; (6) set (5) plus *YEAR*; (7) set (5) plus *IND*; and (8) set (5) plus *YEAR* and *IND*. Panel B presents the importance for the eighth specification for both firms with and without a main bank in Panel A. Panel C presents the number of relevant items based on an *R*-squared threshold. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Table 4. Contingent Governance

Panel A. Combined Relevance for the High Default Risk Group

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
(1)	-18.9%	0.3%	-19.2%	-1.518	
(2)	11.9%	34.3%	-22.4%	-2.684	**
(3)	13.0%	48.1%	-35.1%	-4.050	***
(4)	21.4%	51.8%	-30.4%	-3.837	***
(5)	21.6%	52.8%	-31.2%	-3.570	***
(6)	48.9%	61.1%	-12.1%	-2.131	**
(7)	22.5%	52.7%	-30.2%	-3.496	***
(8)	48.5%	61.2%	-12.7%	-2.225	**

Panel B. Combined Relevance for the Non-high Default Risk Group

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
(1)	-0.2%	-3.4%	3.2%	0.725	
(2)	24.2%	29.9%	-5.7%	-1.934	*
(3)	36.1%	35.3%	0.8%	0.243	
(4)	41.0%	43.5%	-2.5%	-0.792	
(5)	46.2%	49.0%	-2.8%	-0.921	
(6)	78.0%	78.8%	-0.8%	-0.232	
(7)	46.8%	49.6%	-2.8%	-0.912	
(8)	78.1%	79.0%	-1.0%	-0.274	

Panel C. Importance of Individual Accounting Items for the High Default Risk Group

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
EARN	-0.28%	0.37%	-0.64%	-0.707	
BVE	2.98%	1.21%	1.77%	1.197	
CASH	0.87%	0.72%	0.15%	0.213	
CA	1.76%	7.60%	-5.83%	-6.368	***
PPE	0.02%	2.35%	-2.33%	-5.774	***
INTAN	-0.74%	0.30%	-1.05%	-1.108	
CL	1.39%	1.25%	0.14%	0.200	
FL	0.36%	0.12%	0.24%	1.931	*
REV	0.03%	0.26%	-0.22%	-1.892	*
COS	-0.06%	0.04%	-0.10%	-0.597	
SGA	-0.09%	0.13%	-0.22%	-1.768	*
IDI	0.07%	0.48%	-0.40%	-3.421	***
IDE	5.56%	34.69%	-29.13%	-14.326	***
TAX	-0.20%	0.36%	-0.55%	-1.755	*
REVGR	0.27%	0.06%	0.21%	0.896	
EARNGR	-0.83%	-0.04%	-0.78%	-1.101	
CFO	0.61%	0.49%	0.12%	0.115	
CFI	0.13%	-0.02%	0.15%	0.862	
CFF	-0.14%	0.11%	-0.26%	-0.834	
DIV	0.28%	0.06%	0.22%	0.471	
OCI	-0.24%	0.17%	-0.41%	-0.816	
AOCI	0.39%	-0.04%	0.43%	1.130	
RD	0.59%	0.21%	0.38%	0.899	
ADV	-0.10%	0.00%	-0.10%	-0.715	
ALLOW	0.11%	1.53%	-1.43%	-4.449	***
DTAX	0.28%	0.00%	0.28%	1.003	
IND	0.09%	0.62%	-0.53%	-6.531	***
YEAR	35.38%	8.17%	27.22%	9.944	***
R-squared	48.49%	61.16%	-12.67%	-2.225	**

Panel D. Importance of Individual Accounting Items for the Non-high Default Risk Group

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
EARN	0.84%	0.04%	0.80%	6.163	***
BVE	-0.02%	0.11%	-0.12%	-2.613	**
CASH	0.57%	0.08%	0.49%	2.770	**
CA	0.34%	0.12%	0.23%	2.221	**
PPE	0.07%	0.16%	-0.10%	-1.603	
INTAN	0.11%	0.14%	-0.03%	-0.522	
CL	0.31%	0.22%	0.09%	0.752	

FL	0.03%	0.05%	-0.02%	-0.535	
REV	0.05%	0.05%	0.00%	-0.033	
COS	0.04%	0.08%	-0.05%	-0.589	
SGA	0.01%	0.84%	-0.83%	-2.446	**
IDI	0.04%	0.02%	0.02%	0.263	
IDE	3.06%	0.57%	2.49%	6.607	***
TAX	0.13%	0.10%	0.03%	0.530	
REVGR	0.01%	0.03%	-0.01%	-0.339	
EARNGR	0.04%	0.08%	-0.04%	-1.032	
CFO	0.02%	-0.02%	0.04%	0.439	
CFI	0.04%	0.04%	0.00%	-0.004	
CFF	0.06%	0.03%	0.03%	0.662	
DIV	1.34%	2.39%	-1.04%	-2.389	**
OCI	0.14%	0.12%	0.02%	0.326	
AOCI	0.06%	0.11%	-0.05%	-0.476	
RD	-0.01%	0.17%	-0.18%	-1.085	
ADV	0.02%	0.02%	0.00%	0.145	
ALLOW	0.00%	2.60%	-2.59%	-2.427	**
DTAX	0.08%	0.09%	-0.01%	-0.159	
IND	0.06%	0.57%	-0.52%	-5.737	***
YEAR	70.60%	70.23%	0.38%	0.214	
R-squared	78.05%	79.04%	-0.99%	-0.274	

Note: Table 4 presents the result of contingent governance. Panels A and B presents the results for the high and non-high default risk group, respectively. We conduct the analysis using eight sets of specifications: (1) traditional items only; (2) traditional items and stock items; (3) traditional items and flow items; (4) traditional items, stock items, and flow items; (5) traditional items, stock items, flow items, and non-traditional items; (6) set (5) plus *YEAR*; (7) set (5) plus *IND*; and (8) set (5) plus *YEAR* and *IND*. Panels C and D present of the importance for the eighth specification for the high default risk group and the non-high default risk group, respectively. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Table 5. Alternative Machine Learning Model

Panel A. Combined Relevance Using AdaBoost

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
(1)	-7.1%	1.4%	-8.5%	-1.640	
(2)	22.6%	33.1%	-10.5%	-3.522	***
(3)	34.8%	41.9%	-7.0%	-1.793	*
(4)	40.4%	48.2%	-7.7%	-2.640	**
(5)	45.9%	52.2%	-6.3%	-1.768	*
(6)	71.9%	73.1%	-1.2%	-0.318	
(7)	46.9%	52.5%	-5.6%	-1.701	
(8)	72.7%	74.2%	-1.5%	-0.404	

Panel B. Importance of Individual Accounting Items Using AdaBoost

	MBank=1	*MBank*=0	*Diff.*	*t-value*	
EARN	1.28%	0.34%	0.94%	3.514	***
BVE	0.33%	1.05%	-0.72%	-1.525	
CASH	0.16%	0.02%	0.14%	0.982	
CA	0.35%	0.19%	0.16%	1.386	
PPE	0.24%	0.36%	-0.12%	-0.865	
INTAN	-0.12%	0.15%	-0.26%	-2.502	**
CL	1.60%	1.43%	0.17%	0.342	
FL	0.13%	0.07%	0.06%	0.980	
REV	-0.08%	0.16%	-0.24%	-2.002	*
COS	0.03%	0.08%	-0.05%	-0.589	
SGA	-0.01%	0.69%	-0.70%	-2.106	**
IDI	0.09%	0.03%	0.06%	0.651	
IDE	2.77%	7.85%	-5.08%	-4.318	***
TAX	0.22%	0.14%	0.08%	0.681	
REVGR	-0.03%	0.07%	-0.10%	-1.377	
EARNGR	0.25%	0.21%	0.04%	0.359	
CFO	0.09%	0.69%	-0.60%	-1.352	
CFI	0.07%	0.16%	-0.09%	-0.548	
CFF	0.10%	0.19%	-0.09%	-0.599	
DIV	0.82%	2.10%	-1.28%	-2.556	**
OCI	0.10%	0.14%	-0.04%	-0.287	
AOCI	0.04%	0.16%	-0.12%	-1.009	
RD	0.26%	0.14%	0.12%	0.895	
ADV	-0.01%	0.11%	-0.12%	-1.869	*
ALLOW	0.18%	2.19%	-2.00%	-5.174	***
DTAX	0.10%	0.06%	0.04%	0.312	
IND	0.29%	0.98%	-0.69%	-4.361	***
YEAR	63.42%	54.43%	8.99%	3.491	***
R-squared	72.66%	74.17%	-4.73%	-0.404	

Note: Table 5 presents the results of robustness tests where the machine learning model is changed to AdaBoost. Panel A presents the *R*-squared using AdaBoost. We conduct the analysis using eight sets of specifications: (1) traditional items only; (2) traditional items and stock items; (3) traditional items and flow items; (4) traditional items, stock items, and flow items; (5) traditional items, stock items, flow items, and non-traditional items; (6) set (5) plus *YEAR*; (7) set (5) plus *IND*; and (8) set (5) plus *YEAR* and *IND*. Panel B presents the importance for the eighth specification using AdaBoost. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Table 6. Alternative Hyperparameters

Panel A. Combined Relevance Under Alternative Hyperparameters

		Only Accounting Items			Including Fixed Effects		
		MBank=1	*MBank*=0	*Diff.*	*MBank*=1	*MBank*=0	*Diff.*
(1) Main Analysis		44.8%	53.7%	-8.8%	73.5%	75.0%	-1.6%
(2) Robustness Test	Mean	45.8%	53.3%	-7.6%	74.5%	74.1%	0.4%
	Min	43.7%	51.1%	-7.4%	73.7%	75.7%	-2.0%
	Max	47.2%	55.9%	-8.7%	75.2%	75.7%	-0.5%

Panel B. Importance of Individual Accounting Items Under Alternative Hyperparameters

	(1) Main Analysis		(2) Robustness Test	
	MBank=1	*MBank*=0	*MBank*=1	*MBank*=0
EARN	1.4%	0.2%	1.6%	0.3%
BVE	0.5%	1.0%	0.4%	1.6%
CASH	0.2%	0.2%	0.2%	0.4%
CA	0.7%	0.3%	0.7%	0.3%
PPE	0.2%	0.7%	0.2%	0.8%
INTAN	0.1%	0.2%	0.1%	0.2%
CL	2.1%	2.0%	1.0%	1.5%
FL	0.2%	0.1%	0.2%	0.1%
REV	0.1%	0.2%	0.0%	0.2%
COS	0.0%	0.1%	0.0%	0.6%
SGA	0.0%	0.6%	0.0%	0.8%
IDI	0.1%	0.2%	0.1%	0.2%
IDE	5.3%	10.3%	5.1%	11.0%
TAX	0.3%	0.1%	0.3%	0.2%
REVGR	0.0%	0.1%	0.0%	0.1%
EARNGR	0.1%	0.1%	0.1%	0.0%
CFO	0.1%	1.0%	0.1%	0.4%
CFI	0.2%	0.2%	0.2%	0.1%
CFF	0.1%	0.2%	0.1%	0.2%
DIV	1.2%	1.8%	1.0%	1.5%
OCI	0.1%	0.1%	0.1%	0.1%
AOCI	0.2%	0.2%	0.2%	0.2%
RD	0.2%	0.2%	0.1%	0.2%
ADV	0.0%	0.1%	0.0%	0.0%
ALLOW	0.2%	2.1%	0.1%	1.8%
DTAX	0.2%	0.1%	0.2%	0.1%
IND	0.2%	0.9%	0.3%	0.6%
YEAR	59.3%	51.6%	62.2%	50.5%
R-squared	73.5%	75.0%	74.5%	74.1%

Note: Table 6 presents the results of robustness tests where hyperparameters are changed, comparing with the result in main analysis. Panel A presents the *R*-squared in changing hyperparameters. We conduct the analysis using two sets of specifications: only accounting items and all items including fixed effects. Panel B presents the importance for the eighth specification in changing hyperparameters. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Table 7. Alternative Number of Folds

Panel A. Combined Relevance with Varying Number of Folds

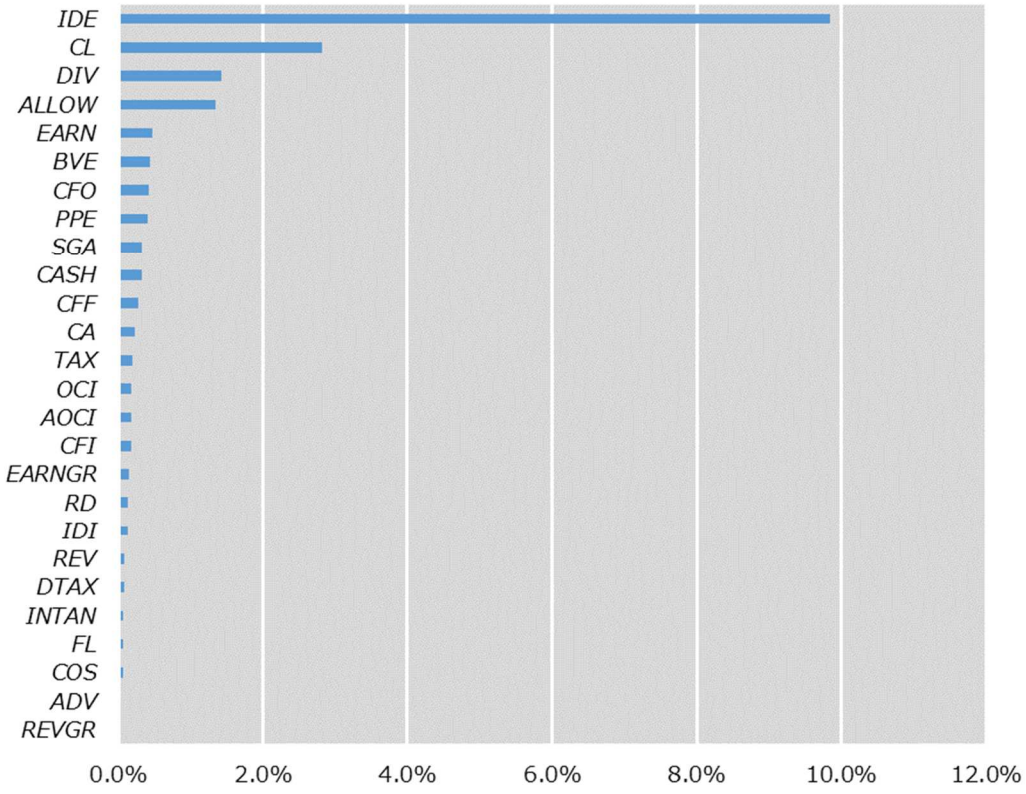
		Only Accounting Items			Including Fixed Effects		
		MBank=1	*MBank*=0	*Diff.*	*MBank*=1	*MBank*=0	*Diff.*
(1) Main Analysis		44.8%	53.7%	-8.8%	73.5%	75.0%	-1.6%
(2) Robustness Test	Mean	44.2%	53.4%	-9.2%	73.0%	74.8%	-1.8%
	Min	43.6%	52.4%	-8.9%	71.4%	73.9%	-2.5%
	Max	45.3%	54.2%	-8.9%	74.0%	75.4%	-1.4%

Panel B. Importance of Individual Accounting Items with Varying Number of Folds

	(1) Main Analysis		(2) Robustness Test	
	MBank=1	*MBank*=0	*MBank*=1	*MBank*=0
EARN	1.4%	0.2%	1.4%	0.3%
BVE	0.5%	1.0%	0.5%	0.9%
CASH	0.2%	0.2%	0.2%	0.3%
CA	0.7%	0.3%	0.6%	0.3%
PPE	0.2%	0.7%	0.2%	0.7%
INTAN	0.1%	0.2%	0.1%	0.2%
CL	2.1%	2.0%	1.9%	2.0%
FL	0.2%	0.1%	0.2%	0.2%
REV	0.1%	0.2%	0.1%	0.2%
COS	0.0%	0.1%	0.0%	0.1%
SGA	0.0%	0.6%	0.0%	0.7%
IDI	0.1%	0.2%	0.1%	0.2%
IDE	5.3%	10.3%	5.2%	10.2%
TAX	0.3%	0.1%	0.2%	0.1%
REVGR	0.0%	0.1%	0.0%	0.1%
EARNGR	0.1%	0.1%	0.1%	0.1%
CFO	0.1%	1.0%	0.1%	1.0%
CFI	0.2%	0.2%	0.2%	0.2%
CFF	0.1%	0.2%	0.1%	0.3%
DIV	1.2%	1.8%	1.2%	1.9%
OCI	0.1%	0.1%	0.1%	0.2%
AOCI	0.2%	0.2%	0.2%	0.2%
RD	0.2%	0.2%	0.2%	0.2%
ADV	0.0%	0.1%	0.0%	0.0%
ALLOW	0.2%	2.1%	0.1%	2.1%
DTAX	0.2%	0.1%	0.2%	0.1%
IND	0.2%	0.9%	0.3%	0.9%
YEAR	59.3%	51.6%	59.4%	51.3%
R-squared	73.5%	75.0%	73.0%	74.8%

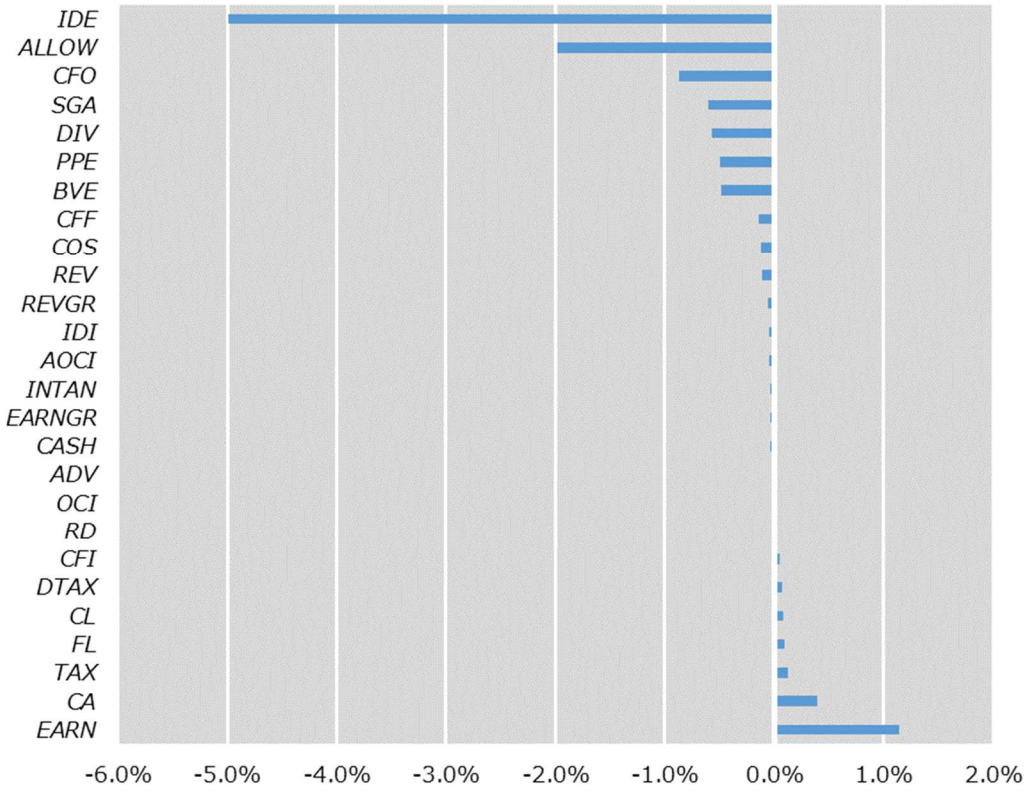
Note: Table 7 presents the results of robustness tests where the number of folds is changed, comparing with the result in main analysis. Panel A presents the *R*-squared with varying the number of folds. We conduct the analysis using two sets of specifications: only accounting items and all items including fixed effects. Panel B presents the importance for the eighth specification with varying the number of folds. *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively (two-tailed test).

Figure 1. Importance of Individual Accounting Items in the Whole Bond Market



Note: Figure 1 presents the importance from column (8) of Table 2, Panel B in descending order, excluding *IND* and *YEAR* from the figure.

Figure 2. Differences of the Importance of Individual Accounting Items between Firms with and without a Main Bank



Note: Figure 2 presents the differences of the importance between firms with and without a main bank from Panel B of Table 3, sorted in ascending order, excluding *IND* and *YEAR* to focus only on the impact of accounting items.