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EXAMINING THE ROLE OF WEB-BASED DISCLOSURE IN MITIGATING DEFAULT RISK- EVIDENCE FROM JAPAN

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ABSTRACT

We examine whether web-based corporate disclosure reduces firms' default risk in the unique institutional and governance setting of Japan. Guided by agency and signaling theories, we hypothesize that enhanced online disclosure mitigates information asymmetry, strengthens market credibility, and lowers the likelihood of financial distress. Using 35,920 firm-year observations from 2007–2022, we employ Merton's distance-to-default as our primary measure of default risk and capture disclosure quality along four dimensions—massiveness, intelligibility, usability, and information amount—drawn from the NIKKEI Corporate Governance Evaluation System. Firm fixed-effects estimates indicate a robust positive association between disclosure quality and distance-to-default, consistent with lower default probability. The results are robust to alternative accounting- and market-based risk measures (Altman Z-score and CDS spreads) and to alternative estimation techniques. We further show that institutional ownership, analyst coverage, and board independence amplify the risk-reducing effect of web disclosure. Our findings contribute to the corporate disclosure and default risk literatures by isolating the role of dynamic, multidimensional web-based disclosure and by documenting its interaction with external governance mechanisms.

Keywords: Default Risk, Corporate Governance, Web-based Disclosure, Institutional Ownership.

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1. INTRODUCTION

In the digital age, effective and transparent disclosure plays a critical role in reducing information asymmetries (Wang et al., 2025; Romito & Vurro, 2021), facilitating efficient capital allocation (Zamir et al., 2022; Ellili, 2022), and bolstering investor confidence. While traditional disclosure mechanisms like annual reports have long served this purpose, web-based disclosure has recently emerged as a pivotal tool for firms to communicate with stakeholders in real time and at scale. This study is based on the Agency theory (Jensen & Meckling, 1976) which posits that conflicts of interest between managers and shareholders may lead to the withholding of relevant information. This in turn can increase risk premiums for debtholders (Abdi & Omri, 2020) and potentially elevate default risk. Hence, this paper investigates whether web-based disclosure can mitigate a firm's default risk—a key measure of financial distress—by enhancing transparency and reducing uncertainty among investors.

Web-based disclosure provides a more dynamic and receptive communication medium in contrast to traditional annual reports, which are static, backward-looking, and infrequently produced (Wang et al., 2025; Borrero-Domínguez et al., 2024). Unlike annual reports, digital platforms enable continuous and immediate updates, allow for the integration of multiple formats—such as visuals, videos, and interactive dashboards—and reach a broader, more diverse audience, including international stakeholders (Abdi & Omri, 2020). Additionally, the relatively low marginal cost of updating digital content enhances its efficiency as a disclosure mechanism. These characteristics position web-based disclosure as a more effective tool for curbing information asymmetry (Gajewski & Li, 2015) and promoting market efficiency than conventional reporting methods.

Empirical studies have documented various outcomes of disclosure practices (Romito &Vurro, 2021; Rossi &Harjoto, 2020; Ajina et al., 2015; Zamir et al., 2022; Ellili, 2022; Raimo et al., 2021; Michaels & Grüning, 2017). With regard to web-based disclosure specifically, studies have shown its influence on corporate performance (Cormier et al., 2009), market risk (Li, 2012), information asymmetry (Gajewski & Li, 2015), and financing costs (Orens et al., 2010; Wang, 2012; Abdi & Omri, 2020). However, to our knowledge, no study has directly examined the effect of web-based disclosure on corporate default risk.

This gap in the literature is significant because default risk is a critical signal of firm health, influencing everything from investor sentiment to capital access and policy response (Rego et al., 2009). This paper fills that gap by empirically testing the impact of web-based disclosure on firms' default risk using a unique dataset and focusing on Japan.

Japan offers a distinctive institutional and governance context that underscores the relevance of this study. Historically, Japanese firms operated within keiretsu networks, with main banks and affiliated firms as major shareholders (Cooke, 1996). This structure enabled private information exchange and reduced incentives for public disclosure (Aman et al., 2021). However, recent decades have seen a marked decline in stable shareholding (Yoshikawa & McGuire, 2008) and a significant rise in foreign institutional ownership—from 5% in 1990 to 30.4% in 2021. This shift has made external transparency through web-based disclosure increasingly vital. Despite Japan's high national ranking on corruption perception indices (Transparency International, 2022), firm-level transparency remains low, particularly in performance-related disclosure. Thus, Japan provides an ideal backdrop to study whether web-based disclosure can mitigate default risk under evolving corporate governance norms.

Using 35,920 firm-year observations from 2007 to 2022, we utilize the four dimensions of web-based disclosure—massiveness, intelligibility, usability, and information amount—as developed by the NIKKEI CGES database. We measure default risk using the market-based distance-to-default (DD) metric. Employing firm fixed effects as our baseline estimation method, we find that higher quality web-based disclosure is significantly associated with higher DD, implying reduced default risk. We find that the effect is amplified in firms with greater institutional ownership, higher analyst coverage, and more independent boards—supporting the monitoring role of external governance in enhancing the efficacy of disclosure. These results remain robust across alternative risk proxies and alternative estimation techniques.

This study contributes to the literature in several important ways. First, while most disclosure research centers on annual reports, we isolate web-based disclosure as an independent and dynamic communication tool. We focus on the unique attributes of web-based disclosure- such as interactivity, accessibility and real- time updates and try to understand how these might influence investor's risk perceptions. Second, we introduce a unique multidimensional dataset to quantify disclosure quality. Third, instead of exploring the determinants of web-based disclosure

(Prabowo & Angkoso, 2006; Xiao et al., 2004; Bollen et al., 2006; Ettredge et al., 2002; Marston & Polei, 2004; Debreceny et al., 2002), we focus on its impact on a largely unexplored outcome—default risk. Fourth, by examining Japanese firms, we extend the literature on both default risk determinants and corporate transparency in a non-Anglo-Saxon context. Finally, our findings have practical implications for policymakers and regulators aiming to enhance disclosure standards and financial market stability.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 outlines the research methodology. Section 4 presents the empirical analysis and results. Section 5 examines the mediating role of corporate governance mechanisms. Section 6 concludes with a summary of key findings, implications, and directions for future research.

2. LITERATURE REVIEW

2.1 Theoretical Framework

Economic theory suggests that creditors are more likely to offer debt at lower interest rates to firms that provide high-quality voluntary disclosure, as such disclosure mitigates the adverse effects of information asymmetry and reduces agency costs (Basuony & Mohamed, 2014). Web-based disclosure constitutes a critical form of voluntary corporate communication, enabling firms to disseminate timely, relevant financial and non-financial information to a broad audience. By providing real-time access to corporate data, web-based disclosure enhances reliability and transparency, and reduces conflicts of interest between managers and external stakeholders (Achoki et al., 2016).

The relationship between web-based disclosure and default risk can be understood through agency theory and signaling theory. According to agency theory (Jensen & Meckling, 1976), conflicts between managers (agents) and shareholders or debtholders (principals) arise when managers prioritize personal benefits over firm value maximization. Withholding material information exacerbates information asymmetry, prompting creditors to demand higher risk premiums to compensate for the increased uncertainty (Myers, 1977; Abdi & Omri, 2020). This increases the cost of debt and, ultimately, default risk. Voluntary disclosure reduces such asymmetries, enhancing investor confidence and lowering financing costs (Sengupta, 1998; Orens et al., 2010; Gajewski & Li, 2015). Web-based disclosure, in particular, offers universal,

low-cost access to information, making it an effective mechanism to address agency problems and reduce default risk. Interestingly, enhanced web-based disclosure may mitigate these agency problems by improving transparency and reducing bid-ask spreads (Leuz & Verrecchia, 2000; Yin et al., 2024).

Signaling theory (Akerlof, 1970; Healy & Palepu, 2001) complements this perspective by suggesting that high-performing firms disclose superior information to differentiate themselves from competitors, attract investors, and obtain external funds at lower cost (Marston & Polei, 2004; Ismail, 2002; Gallego Alvarez et al., 2008). In a globalized market, rapid, high-quality information dissemination signals operational strength and reliability, enhancing creditworthiness. Firms with strong performance have incentives to leverage web-based disclosure to assure creditors of their ability to service debt (Aly et al., 2010), strengthen managerial reputation, and reinforce perceptions of good governance. Complementarily, signaling theory (Akerlof, 1970; Healy & Palepu, 2001) suggests that firms use disclosure to differentiate themselves in capital markets by signaling financial soundness. Improved web-based disclosure may increase investor trust, lower cost of capital (Cheng et al., 2014), and thereby reduce the probability of default.

2.2 Empirical Framework

Extensive research has examined the association between voluntary disclosure and the cost of debt, with the consensus that higher disclosure quality facilitates access to finance at lower cost (Lundholm & Van Winkle, 2006). Boulland et al. (2025) introduce a novel measure of corporate disclosure derived from company websites, which are readily accessible and rich in information. Using historical data from U.S. public firms, they construct this measure, validate its accuracy by correlating it with existing disclosure and information asymmetry metrics, and investigate its determinants. They then apply this measure to examine disclosure practices in U.S. private firms and French firms' adherence to nonfinancial disclosure regulations. Their findings demonstrate that this website-based measure serves as a valuable addition to traditional disclosure metrics, which primarily focus on investor-related information in public capital markets. This makes this measure particularly relevant for research on private firms, non-investor audiences, and nonfinancial disclosures. Building on this, we posit that if web-based disclosure reduces the cost

of debt, it will also lower default risk, as reduced financing costs enhance a firm's ability to meet its obligations.

Prior studies have consistently reported a negative relationship between web-based disclosure and information asymmetry (Cormier et al., 2009; Yoon et al., 2011; Blankespoor et al., 2014; Gajewski & Li, 2015). These findings are attributed to the broad reach and immediacy of internet-based communication. However, some evidence suggests that this relationship may be insignificant if online disclosures lack credibility or fail to provide substantive insights (Chang et al., 2008; Nel & Baard, 2019). Consequently, Chen et al. (2025) explores the influence of digital transformation on corporate performance, concentrating on both information disclosure and investment. The study focuses on A-share listed companies from 2013 to 2020. Findings indicate an inverted U-shaped correlation between the level of information disclosure in digital transformation and corporate performance, highlighting the importance of balanced disclosure. Furthermore, investments in digital transformation show a positive relationship with corporate performance, suggesting that such investments contribute to improved outcomes. Interestingly, Salin et al. (2024) examines transparency in organizations through the lens of firm disclosure practices and the informativeness of their websites. It employs archival analysis of annual reports from the top 500 publicly listed companies in Malaysia, ranked by market capitalization. Nine independent variables were developed to assess various factors, while business performance, as measured by return on equity (ROE), return on assets (ROA), Tobin's Q, and the market-to-book ratio (MTB), served as the dependent variable. The results reveal no statistically significant relationship between a company's disclosure policy, website informativeness, and its financial performance, leading to the rejection of both hypotheses.

On the other hand, Abdi and Omri (2020), study a sample consisting of 237 non-financial companies listed in the MENA region for the year 2017. Multiple regression models were employed to analyze the effect of online disclosure on debt costs. The findings demonstrate a significant negative relationship between web-based disclosure and the company's cost of debt. These results confirm the hypothesis that the information disclosed on company websites holds economic value for creditors in this region. Specifically, web-based disclosure appears to reduce information asymmetry and creditor uncertainty, which in turn lowers the cost of debt.

Orens et al. (2010) conducted a study on a sample of 267 companies in four countries of continental Europe (Belgium, France, Germany and Netherland). The study shows that disclosing economically valuable intellectual capital information online reduces the cost of both debt and equity financing. By lowering information asymmetry, web-based disclosure reduces creditors' uncertainty regarding a firm's capacity to meet obligations, thereby lowering the cost of capital and, by extension, default risk. Drawing on the theoretical and empirical evidence above, we formally state our hypothesis as follows:

H1*: Higher levels of web-based disclosure are associated with lower default risk among firms.*

3. METHODOLOGY

3.1 Data and sample

We compile our dataset from three primary sources. First, the key variables measuring the quality of web-based disclosure are obtained from the NIKKEI Corporate Governance Evaluation System (CGES), a widely recognized and comprehensive source of standardized, annually updated indicators on Japanese corporate governance and disclosure practices. Second, firm-level default risk measures are sourced from the Credit Research Initiative (CRI) database. Third, control variables are drawn from LSEG Workspace (formerly EIKON), which provides consistent financial and market data. Datasets are merged using ticker codes to ensure accurate matching. Following prior literature on corporate disclosure and default risk, financial firms are excluded due to their distinct regulatory and capital structures. After removing observations with missing data, the final sample comprises 35,920 firm-year observations for the baseline regression over the period 2007–2022, with the number of observations varying across regression specifications.

3.2 Dependent Variable: Merton's Distance-to-Default (DD)

We use Merton's Distance-to-Default (DD) as our primary dependent variable and market-based measure of default risk. The DD framework, grounded in Merton's (1974) structural model and the Black–Scholes option-pricing theory, estimates how far a firm's asset value is from its default point, expressed in standard deviation units. Lower DD values indicate higher default risk.

While the conventional DD measure is widely applied (Chava & Purnanandam, 2010; Anginer et al., 2014), it faces practical challenges, including difficulties in estimating asset returns and market values, and the omission of certain liabilities. To address these issues, we use the enhanced specification developed by Duan and Wang (2012), which adjusts the definition of the default point to incorporate sector-specific calibrations for other liabilities.

Our DD data are obtained from the Credit Research Initiative (CRI) at the National University of Singapore, which applies this improved estimation method. The CRI dataset is widely used in the literature (Shin & Kim, 2015; Leroy & Lucotte, 2017; Ali et al., 2018; Nadarajah et al., 2021), ensuring methodological robustness and comparability with prior research.

3.3 Key Independent Variable: Web-based Disclosure

Our main independent variable is web-based disclosure quality, evaluated across four dimensions reported in the NIKKEI Corporate Governance Evaluation System (CGES) and calculated by Nikko Investor Relations. These standardized measures have an average value of 50 points and a standard deviation of 10 points, facilitating consistent comparison across firms and years.

- *Massiveness* – Assesses the comprehensiveness of the firm's website in covering a wide range of corporate activities, including operational, strategic, and governance-related information.
- *Intelligibility* – Measures the clarity and ease of understanding of the content, ensuring that it is accessible to a broad audience without requiring specialized knowledge.
- *Usability* – Evaluates the ease of navigation, organization, and interactivity of the website, enabling users to locate and utilize information efficiently.
- *Information Amount* – Captures the quantity and materiality of financial and non-financial data provided on the website.

Each score ranges from 0 to 100, with higher scores indicating stronger performance in the respective dimension. These metrics allow us to investigate both the aggregate and individual effects of different aspects of web-based disclosure quality on a firm's default risk.

3.4 Control variables

Following prior studies (Ali et al., 2018; Haque et al., 2024), we include several control variables. Firm size is measured as the logarithm of total sales (LNS), with larger firms expected to exhibit higher DD due to greater stability and resource access. Capital-sales ratio (K/S) captures tangible asset intensity, which is generally associated with lower bankruptcy risk. Market power/free cash flow is proxied by EBITDA-to-sales (Y/S), with higher values indicating stronger debt-servicing capacity. R&D intensity (R&D/K) is measured as R&D expenditure to property, plant, and equipment, with missing values set to zero, and an R&D dummy (RDUM) equals one if R&D data are reported. Growth opportunities are proxied by capital expenditure-to-PPENT (I/K), where higher values may increase default risk. Profitability is measured by return on assets (ROA), expected to have a positive effect on DD. Leverage is total debt-to-equity, where higher leverage increases default risk. Firm age is the log of years since incorporation, with older firms expected to be more stable. All control variables are winsorized at the 1% level in both tails to mitigate outlier effects.

3.5 Estimation model

To test our reported hypothesis (H1), we estimate the following fixed-effects model, which controls for firm-specific effects.

$$DD_{i,t} = \alpha_0 + \beta_1 WEBQUALITY_{i,t} + \beta_2 LNS_{i,t} + \beta_3 K/S_{i,t} + \beta_4 Y/S_{i,t} + \beta_5 R\&D/K_{i,t} + \beta_6 RDUM_{i,t} + \beta_7 I/K_{i,t} + \beta_8 ROA_{i,t} + \beta_9 LEVERAGE_{i,t} + \beta_{10} AGE_{i,t} i,t + Year_t + \varepsilon_{i,t} \quad (1)$$

Here, DD = is the measure of default risk calculated based on equation 3 (Merton's distance-to-default, DD); *WEBQUALITY* measures of web-based disclosure quality, represented by the four dimensions: *massiveness*, *intelligibility, usability, and information amount*; *LNS*= Firm Size is measured by the natural logarithm of total assets; *K/S*= capital to sales ratio; *Y/S*= EBITDA to sales ratio; *R&D/K*= ratio of research and development expenditures to property plant and equipment (*PPENT*) denoted by *K*; *RDUM*= Dummy Variable, takes 1 if R&D is available or 0 for missing data; *I/K*= ratio of firms' capital expenditure to property, plant, and equipment; *ROA*= return on assets; *LEVERAGE*= total debt to total assets; *Age* = Natural logarithm of a firm's AGE; *YEAR*= year dummies and ε_i = the error term.

4. EMPIRICAL ANALYSIS

4.1 Summary Statistics

Table 1 reports the descriptive statistics for all variables. The mean Distance-to-Default (DD) is 4.154 with a standard deviation of 2.426, indicating substantial variation in default risk across firms. The four web-based disclosure dimensions have mean (median) scores close to 49%, with modest dispersion: Massiveness (49.371%, 48.3%), Intelligibility (49.379%, 47.9%), Usability (49.382%, 48.1%), and Information Amount (49.354%, 47.9%). Ranges vary from 0% to approximately 96%–100%, with standard deviations of 8.6–9.5 percentage points, reflecting meaningful cross-firm differences in disclosure quality.

For the controls, firms have an average log sale (LNS) of 10.64, a mean capital-to-sales ratio (K/S) of 0.344, and an average EBITDA-to-sales ratio (Y/S) of 0.083. The mean capital expenditure-to-PPENT ratio (I/K) is 0.157, while ROA averages 5.57%. The average leverage ratio is 21.8%, and firms have an average age of 36.68 years. Overall, the data indicate considerable heterogeneity in both disclosure practices and firm characteristics, providing a rich setting to examine the link between web-based disclosure and default risk.

Table 1: Summary Statistics

	N	Mean	Std. Dev.	Median	Min	Max
Distance-to-Default (DD)	35920	4.154	2.426	3.671	0.185	12.690
Massiveness	35920	49.371	8.627	48.300	0.000	95.900
Intelligibility	35920	49.379	9.539	47.900	0.000	94.900
Usability	35920	49.382	9.380	48.100	0.000	100.000
Information amount	35920	49.354	9.525	47.900	0.000	96.600
LNS	35920	10.640	1.671	10.511	2.079	16.955
K/S	35920	0.344	0.367	0.260	0.004	2.290
Y/S	35920	0.083	0.081	0.074	-0.251	0.354
R&D/K	35920	0.157	2.114	0.008	-0.091	216.857

	N	Mean	Std. Dev.	Median	Min	Max
I/K	35920	0.157	0.369	0.105	-0.004	39.957
ROA	35920	5.570	7.546	4.540	-20.459	35.202
LEVERAGE	35920	0.218	0.204	0.178	0.000	8.813
Age	35920	36.683	20.261	29.000	2.000	70.000
INST	35920	12.716	14.427	7.430	0.000	85.600
Analyst	35920	5.225	5.102	3.000	1.000	30.000
IDIR	35920	0.086	1.202	0.000	0.000	69.990
Z-score	35920	3.426	2.773	2.700	0.200	19.200
CDS	35920	13.057	20.570	5.551	0.007	125.569

Note: This table presents summary statistics of Distnace-to-Default (DD), Web-disclosure characteristics and other control variables used in this study. All variables are winsorized at the 1–99% levels.

4.2 Correlation Analysis

Table 2 reports the Pearson correlation coefficients for all variables. DD is positively associated with all four web-based disclosure dimensions, with coefficients ranging from 0.107 to 0.148, indicating that higher disclosure quality is linked to lower default risk. The disclosure measures themselves are strongly correlated (0.710–0.920), reflecting their common derivation from the CGES framework.

For the control variables, DD shows positive correlations with firm size (LNS), profitability (ROA), and operating performance (Y/S), and a negative correlation with leverage, consistent with theoretical predictions such as Orens et al. (2010). Correlations among control variables are generally moderate, suggesting no multicollinearity concerns in the regression model.

Table 2: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) DD	1.000												
(2) Massiveness	0.137	1.000											
(3) Intelligibility	0.121	0.920	1.000										
(4) Usability	0.107	0.891	0.710	1.000									

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(5) Information amount	0.148	0.929	0.811	0.735	1.000								
(6) LNS	0.130	0.468	0.377	0.394	0.513	1.000							
(7) K/S	0.049	-0.092	-0.096	-0.073	-0.083	-0.048	1.000						
(8) Y/S	0.353	0.167	0.142	0.138	0.177	0.139	0.287	1.000					
(9) R&D/K	0.004	0.020	0.017	0.024	0.016	-0.089	-0.044	-0.095	1.000				
(10) I/K	-0.008	0.056	0.051	0.050	0.053	-0.068	-0.107	-0.002	0.138	1.000			
(11) ROA	0.337	0.136	0.138	0.099	0.136	0.118	-0.142	0.562	-0.070	0.053	1.000		
(12) LEVERAGE	-0.426	-0.058	-0.051	-0.049	-0.060	0.036	0.276	-0.130	-0.035	-0.034	-0.290	1.000	
(13) Age	-0.044	0.043	-0.011	0.059	0.070	0.419	0.228	0.032	-0.049	-0.098	-0.155	0.112	1.000

Note: This table presents the correlation matrix.

4.3 Baseline Regression Results

Table 3 reports the baseline fixed-effects regression results examining the relationship between web-based disclosure quality and firms' Distance-to-Default (DD). In Columns (1)– (4), we assess each of the four disclosure dimensions—massiveness, intelligibility, usability, and information amount—without control variables. All four coefficients are positive and statistically significant at the 1% level, indicating that higher quality in each dimension is associated with greater DD, and therefore lower default probability. For example, *Massiveness* exhibits a coefficient of 0.034 ($p < 0.01$), consistent with the notion that broader, more comprehensive web content improves transparency and fosters investor confidence. This finding aligns with prior evidence from diverse contexts (Pour & Imanzadeh, 2017; DaSilva Rodrigues & Galdi, 2017; Nel et al., 2018) showing that voluntary online disclosure reduces information asymmetry and enhances market trust. Similarly, the positive effects of *intelligibility, usability, and information amount* echo Abdi and Omri, (2020), who documents a negative association between web-based disclosure and the cost of debt in MENA countries—implying reduced financing costs and, in turn, lower default risk.

Columns (5)– (8) incorporate the full set of control variables. The positive and highly significant coefficients for all four disclosure dimensions remain robust, underscoring the independent effect of web-based disclosure on default risk reduction. Among the controls, firm size (LNS) is positively associated with DD, consistent with the lower default probability of larger firms documented by Nguyen (2011) for Japan. The capital-sales ratio (K/S) also shows a positive relationship, suggesting that capital-intensive firms benefit from stable earnings generation through efficient utilization of tangible assets. Measures of operating performance (Y/S) and profitability (ROA) are likewise positively related to DD, while R&D intensity (R&D/K) contributes to lower default risk by enhancing firms' long-term competitive position and earnings potential. In contrast, capital expenditure intensity (I/K) and leverage are negatively associated with DD, in line with theoretical expectations that riskier investment strategies and higher debt burdens elevate default risk.

Overall, these findings provide strong empirical support for H1, demonstrating that higher quality across multiple dimensions of web-based disclosure is systematically linked to lower default probability, even after accounting for key firm characteristics.

Table 3: Baseline Regression Results

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent Variable DD								
Massiveness	0.034***				0.012***			
	(25.827)				(8.658)			
Intelligibility		0.024***				0.008***		
		(20.635)				(6.845)		
Usability			0.024***				0.006***	
			(20.173)				(5.501)	
Information amount				0.034***				0.014***
				(28.887)				(10.631)
LNS					0.122***	0.138***	0.142***	0.106***
					(14.114)	(17.039)	(17.620)	(11.913)
K/S					0.773***	0.777***	0.778***	0.768***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable DD								
					(19.762)	(19.858)	(19.874)	(19.632)
Y/S					5.231***	5.243***	5.239***	5.229***
					(30.603)	(30.664)	(30.635)	(30.612)
R&D/K					0.010**	0.010***	0.010***	0.010**
					(2.538)	(2.655)	(2.651)	(2.505)
RDUM					0.545	0.484	0.506	0.528
					(0.912)	(0.810)	(0.846)	(0.883)
I/K					-0.102***	-0.099***	-0.099***	-0.105***
					(-4.022)	(-3.888)	(-3.902)	(-4.131)
ROA					0.030***	0.030***	0.030***	0.030***
					(15.884)	(15.672)	(15.783)	(16.029)
LEVERAGE					-5.861***	-5.866***	-5.864***	-5.855***
					(-96.817)	(-96.849)	(-96.797)	(-96.748)
Age					0.073***	0.069***	0.060***	0.081***
					(5.288)	(4.939)	(4.349)	(5.805)
Constant	2.830***	3.315***	3.332***	2.791***	2.085***	2.190***	2.214***	2.143***
	(43.184)	(56.713)	(56.607)	(46.432)	(3.436)	(3.610)	(3.647)	(3.538)
Observations	35920	35920	35920	35920	35920	35920	35920	35920
R-squared	0.321	0.317	0.317	0.324	0.542	0.542	0.542	0.543
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: This table presents the baseline regression results examining the relationship between Distance-to-default and Web-disclosure. Columns 1-4 reports the model without controls, while Column 5-8 includes firm-level control variables. The dependent variable in both models is Distance-to-Default, a proxy for DD. Control variables includes firm size (LNS), capital intensity (K/S), firm age, profitability (ROA), leverage, investment intensity (I/K), R&D intensity (R&D/K), and other firm characteristics that may influence default risk. All regressions control for industry and year fixed effects. Standard errors are clustered at the firm level, and t-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

4.4 Robustness Test:

To verify the stability of our baseline results, we conduct additional analyses using both alternative measures of default risk and alternative estimation techniques.

4.4.1 Alternative Proxies for Default Risk

We first re-estimate our models using two widely recognized proxies for default risk: the Altman Z-score, an accounting-based measure, and Credit Default Swap (CDS) spreads, a market-based measure.

The Altman Z-score integrates five weighted financial ratios—working capital to total assets, retained earnings to total assets, EBIT to total assets, market value of equity to total liabilities, and sales to total assets—into a composite solvency measure, where higher values indicate lower bankruptcy risk. Results in Columns (1)–(4) of Table 4 indicate that all four dimensions of web-based disclosure are positively related to the Z-score. Massiveness (0.006, $p < 0.01$) and information amount (0.010, $p < 0.01$) are significant at the 1% level, while intelligibility (0.002, $p < 0.10$) and usability (0.002, $p < 0.10$) are significant at the 10% level, suggesting that stronger web-based disclosure is associated with greater financial stability.

CDS spreads measure the cost of insuring against default, with higher spreads reflecting greater market-perceived credit risk. As reported in Columns (5)–(8) of Table 4, all four disclosure dimensions are negatively and significantly related to CDS spreads, with coefficients of –0.079 (massiveness), –0.062 (intelligibility), –0.045 (usability), and –0.073 (information amount), each significant at the 1% level. This pattern indicates that enhanced web-based disclosure reduces creditors' required risk premiums and lowers market-implied default probabilities.

These results, based on both accounting-based and market-based indicators, are consistent with our baseline findings and reinforce the conclusion that web-based disclosure mitigates default risk by reducing information asymmetry and enhancing investor and creditor confidence.

Table 4: Robustness test: Alternative measure of DD: Z score and CDS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Altman Z score				**CDS Spread**			
Massiveness	0.006***				-0.079***			
	(3.754)				(-7.394)			
Intelligibility		0.002*				-0.062***		
		(1.645)				(-7.053)		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Altman Z score				**CDS Spread**			
Usability			0.002*				-0.045***	
			(1.783)				(-5.068)	
Information amount				0.010***				-0.073***
				(6.799)				(-7.179)
LNS	-0.124***	-0.111***	-0.112***	-0.145***	0.386***	0.311***	0.256***	0.411***
	(-12.701)	(-12.112)	(-12.192)	(-14.278)	(5.661)	(4.871)	(4.010)	(5.809)
K/S	-0.579***	-0.576***	-0.576***	-0.584***	-2.885***	-2.906***	-2.915***	-2.868***
	(-12.834)	(-12.775)	(-12.775)	(-12.957)	(-9.319)	(-9.387)	(-9.414)	(-9.261)
Y/S	3.680***	3.690***	3.688***	3.669***	-12.234***	-12.295***	-12.284***	-12.263***
	(18.495)	(18.544)	(18.535)	(18.452)	(-9.050)	(-9.095)	(-9.083)	(-9.072)
R&D/K	0.103***	0.103***	0.103***	0.102***	-0.103***	-0.105***	-0.106***	-0.104***
	(21.590)	(21.698)	(21.685)	(21.501)	(-3.411)	(-3.482)	(-3.496)	(-3.439)
RDUM	-0.896	-0.942	-0.926	-0.877	0.334	0.629	0.543	0.633
	(-1.408)	(-1.480)	(-1.455)	(-1.380)	(0.071)	(0.133)	(0.115)	(0.134)
I/K	0.311***	0.314***	0.313***	0.308***	1.373***	1.355***	1.355***	1.378***
	(10.388)	(10.463)	(10.444)	(10.280)	(6.829)	(6.739)	(6.736)	(6.853)
ROA	0.114***	0.114***	0.114***	0.114***	-0.366***	-0.364***	-0.365***	-0.367***
	(51.749)	(51.654)	(51.663)	(51.921)	(-24.407)	(-24.250)	(-24.332)	(-24.441)
LEVERAGE	-4.880***	-4.882***	-4.882***	-4.874***	39.230***	39.258***	39.245***	39.200***
	(-68.752)	(-68.768)	(-68.760)	(-68.695)	(81.928)	(81.983)	(81.928)	(81.853)
Age	-0.283***	-0.289***	-0.291***	-0.273***	-1.117***	-1.107***	-1.029***	-1.127***
	(-17.884)	(-18.249)	(-18.538)	(-17.200)	(-10.166)	(-10.081)	(-9.461)	(-10.220)
Constant	6.207***	6.308***	6.293***	6.174***	10.052**	9.697**	9.300*	9.235*
	(9.596)	(9.753)	(9.726)	(9.562)	(2.095)	(2.022)	(1.937)	(1.927)
Observations	35920	35920	35920	35920	35920	35920	35920	35920
R-squared	0.524	0.524	0.524	0.525	0.450	0.449	0.449	0.450
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: This table presents robustness tests to address potential endogeneity concerns by employing alternative measures of default risk: Z-score and CDS spreads. Columns 1-4 use variations of the Z-score, while Columns 5-8 use CDS spreads as the dependent variable. The main independent variables of interest are the proxy for web-based disclosure levels. All models include industry and year fixed effects. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

4.4.2 Alternative Estimation Techniques

We further assess robustness by employing estimation methods designed to address potential cross-sectional dependence and outlier sensitivity. First, we apply the Fama–MacBeth (1973) two-step procedure, which estimates annual cross-sectional regressions and averages the coefficients over time, with standard errors adjusted for cross-sectional correlation. Columns (1)–(4) of Table 5 show that massiveness (0.009, $p < 0.05$), intelligibility (0.007, $p < 0.01$), and information amount (0.010, $p < 0.05$) remain positively and significantly related to distance-to-default, while usability (0.004) is positive but not statistically significant.

Second, following Fabisik et al. (2021), we estimate median regressions, which minimize absolute deviations and are less influenced by extreme observations. As shown in Columns (5)–(8) of Table 5, all disclosure dimensions exhibit positive and highly significant coefficients, ranging from 0.010 to 0.018 ($p < 0.01$). The consistency of results across both alternative risk measures and estimation methods provides strong and convergent evidence that greater web-based disclosure is robustly associated with lower default risk.

Table 5: Alternative Estimation technique: Fama Macbeth regression and Median Regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Fama Macbeth				**Median Regression**			
Dependent Variable	DD							
Massiveness	0.009**				0.016***			
	(2.383)				(12.524)			
Intelligibility		0.007***				0.011***		
		(3.175)				(9.588)		
Usability			0.004				0.010***	
			(1.468)				(9.188)	
Information amount				0.010**				0.018***
				(2.531)				(15.837)
LNS	0.180***	0.186***	0.195***	0.173***	0.116***	0.136***	0.139***	0.098***
	(6.750)	(6.955)	(7.177)	(6.497)	(16.284)	(19.023)	(21.020)	(13.678)
K/S	1.061***	1.059***	1.056***	1.061***	1.036***	1.045***	1.026***	1.034***

	(17.721)	(17.739)	(17.424)	(18.049)	(24.293)	(23.870)	(24.745)	(24.343)
Y/S	5.130***	5.179***	5.198***	5.103***	4.664***	4.764***	4.794***	4.560***
	(15.493)	(15.178)	(15.399)	(15.719)	(24.819)	(25.101)	(25.452)	(25.693)
R&D/K	0.077***	0.079***	0.080***	0.075***	0.029	0.035	0.030	0.027
	(3.321)	(3.239)	(3.258)	(3.384)	(0.905)	(1.126)	(0.984)	(0.813)
RDUM	1.100***	1.057***	0.977***	1.041***	0.520	0.419	0.425	0.482
	(3.685)	(3.437)	(3.329)	(3.469)	(0.571)	(0.793)	(0.603)	(0.564)
I/K	-0.405***	-0.388***	-0.380***	-0.414***	-0.093*	-0.090	-0.078***	-0.120**
	(-4.396)	(-4.397)	(-4.318)	(-4.389)	(-1.766)	(-1.468)	(-3.442)	(-2.197)
ROA	0.037***	0.036***	0.036***	0.037***	0.045***	0.045***	0.045***	0.045***
	(5.682)	(5.725)	(5.764)	(5.602)	(21.678)	(21.196)	(21.501)	(23.181)
LEVERAGE	-5.737***	-5.751***	-5.754***	-5.730***	-5.172***	-5.188***	-5.192***	-5.151***
	(-18.449)	(-18.497)	(-18.627)	(-18.346)	(-101.854)	(-92.866)	(-98.332)	(-104.287)
Age	-0.122***	-0.123***	-0.135***	-0.117***	0.016	0.013	0.006	0.020
	(-3.915)	(-4.060)	(-4.592)	(-3.610)	(1.191)	(0.959)	(0.443)	(1.598)
Constant	1.602***	1.669***	1.837***	1.695***	1.035	1.166**	1.197*	1.145
	(4.631)	(5.155)	(5.472)	(5.148)	(1.131)	(2.120)	(1.672)	(1.328)
Observations	35920	35920	35920	35920	35920	35920	35920	35920
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: This table presents results for analyzing the effect of web-disclosure on firm default risk using DD spread as a proxy of default risk. Columns 1-4 presents the results of regression using Fama and Macbeth (1973) and Columns 5-8 presents the results of Median regression as the alternative estimation technique. The dependent variable is DD. T-statistics are in parentheses. Superscripts ***, ** and * denote statistical significance at 1, 5 and 10% level, respectively.*

5. ROLE OF CORPORATE GOVERNANCE MECHANISMS

External governance mechanisms can play a pivotal role in shaping the relationship between web-based disclosure and default risk. Drawing on prior literature, we focus on three key mechanisms: institutional ownership, analyst coverage, and board independence.

5.1 Institutional Ownership

Institutional investors are central to external governance because their investment scale and monitoring capacity constrain managerial discretion (Lima & Hossain, 2018; Sakawa &

Watanabel, 2020). Concentrated institutional holdings create incentives to demand consistent disclosure practices that limit information asymmetry and enhance creditor assessments of firm risk. If institutional monitoring increases the credibility and completeness of web-based disclosure, its effect on reducing default risk should be amplified in firms with higher institutional ownership.

To examine this prediction, the sample is partitioned into high and low institutional ownership subsamples based on the median institutional shareholding. Institutional ownership data are obtained from the NIKKEI CGES database. The baseline specification is then re-estimated for each subsample.

The results, reported in Table 6, show that for firms with high institutional ownership, all four dimensions of web-based disclosure—massiveness, intelligibility, usability, and information amount—are positively and significantly related to Distance-to-Default (DD) at the 1% level. In contrast, for firms with low institutional ownership, the estimated coefficients are smaller in magnitude, statistically insignificant, or negative. These findings indicate that institutional monitoring strengthens the link between web-based disclosure and lower default risk, consistent with the view that external block holders enforce disclosure practices that enhance transparency and creditor confidence.

Table 6: Higher Institutional ownership vs Lower institutional ownership

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	High Institutional Ownership				**Low Institutional Ownership**			
Dependent Variable	DD							
Massiveness	0.009***				0.007***			
	(4.795)				(3.615)			
Intelligibility		0.004***				-0.000		
		(2.794)				(-0.179)		
Usability			0.006***				0.002	
			(3.593)				(1.029)	
Information amount				0.011***				0.010***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High Institutional Ownership				**Low Institutional Ownership**			
				(6.325)				(5.104)
LNS	0.064***	0.081***	0.077***	0.049***	0.130***	-0.136***	0.145***	0.118***
	(4.809)	(6.529)	(6.102)	(3.563)	(9.777)	(-3.677)	(11.318)	(8.704)
K/S	0.720***	0.723***	0.721***	0.717***	0.749***	0.289***	0.752***	0.745***
	(11.466)	(11.501)	(11.476)	(11.418)	(14.656)	(3.439)	(14.712)	(14.586)
Y/S	6.601***	6.610***	6.598***	6.601***	3.272***	-0.318	3.284***	3.266***
	(25.776)	(25.800)	(25.753)	(25.792)	(14.246)	(-1.396)	(14.292)	(14.220)
R&D/K	0.020**	0.020***	0.020**	0.020**	0.004	-0.000	0.004	0.003
	(2.546)	(2.634)	(2.567)	(2.566)	(0.824)	(-0.034)	(0.882)	(0.789)
RDUM	0.470	0.428	0.456	0.447	1.765		1.634	1.813
	(0.644)	(0.586)	(0.624)	(0.613)	(1.038)		(0.960)	(1.066)
I/K	-0.377***	-0.367***	-0.369***	-0.385***	-0.084***	-0.014	-0.083***	-0.085***
	(-5.241)	(-5.108)	(-5.128)	(-5.353)	(-3.060)	(-0.686)	(-3.022)	(-3.096)
ROA	0.024***	0.024***	0.024***	0.024***	0.032***	0.018***	0.032***	0.033***
	(8.559)	(8.456)	(8.567)	(8.587)	(12.524)	(8.018)	(12.420)	(12.667)
LEVERAGE	-6.737***	-6.735***	-6.732***	-6.740***	-5.252***	-3.004***	-5.258***	-5.243***
	(-67.373)	(-67.320)	(-67.305)	(-67.435)	(-66.946)	(-25.712)	(-67.020)	(-66.816)
Age	0.165***	0.160***	0.158***	0.171***	-0.005	0.204***	-0.019	0.004
	(7.994)	(7.733)	(7.671)	(8.258)	(-0.272)	(5.039)	(-1.002)	(0.230)
Constant	2.910***	3.005***	2.971***	2.964***	1.147	5.319***	1.430	1.065
	(3.902)	(4.026)	(3.982)	(3.981)	(0.670)	(14.114)	(0.835)	(0.623)
Observations	15926	15926	15926	15926	19994	19994	19994	19994
R-squared	0.607	0.606	0.606	0.607	0.508	0.798	0.508	0.509
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: This table presents the moderating role of external governance—proxied by Institutional Ownership—on the relationship between Web disclosure and DD. Columns 1-4 show results for high Institutional Ownership, while Columns 5-8 show results for low Institutional Ownership. The dependent variable is DD, proxied by Distance-to-Default. The key independent variable is Web disclosure. All models control for firm-specific characteristics. Industry and year fixed effects are included in all regressions. Robust standard errors are clustered at the firm level. T-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.*

5.2 Analyst coverage

Analyst coverage serves as an important external governance mechanism capable of mitigating agency conflicts and information asymmetry. Prior research suggests that analysts rely on timely and comprehensive corporate disclosures, including information disseminated through firm websites, to refine forecasts and enhance market transparency (Watkins & Harris, 2002). Firms that maintain extensive online disclosure are perceived as less likely to withhold unfavorable information, thereby improving investor and creditor confidence (Healy & Palepu, 2001). Higher analyst coverage can therefore exert additional monitoring pressure on managers, discouraging excessive risk-taking and potentially reducing default risk (Mouselli et al., 2014).

We measure analyst coverage as the number of unique analysts issuing earnings forecasts for a firm over a 12-month period, sourced from the I/B/E/S database. Following convention, missing values are replaced with zero, and the coverage variable is defined as the natural logarithm of 1+ the number of analysts. Firms are classified as having *high* coverage if their analyst count is above the sample median, and *low* coverage otherwise.

Results in Table 7 show that for all four web-disclosure dimensions—massiveness, intelligibility, usability, and information amount—the coefficients are positive and statistically significant for both high and low coverage groups. However, the magnitude of the coefficients is consistently larger under high analyst coverage. For instance, in the high coverage group, the coefficient for massiveness is 0.012 (1% significance), compared to 0.008 (5% significance) for the low coverage group. Similarly, intelligibility records coefficients of 0.007 (1% significance) for high coverage and 0.005 (10% significance) for low coverage; usability shows 0.006 (1%) versus 0.005 (10%), and information amount 0.014 (1%) versus 0.008 (1%).

These results indicate that the positive relationship between web-based disclosure and distance-to-default is more pronounced when firms are subject to greater analyst scrutiny. In such settings, disclosure is more likely to be effectively processed, verified, and incorporated into market assessments, thereby strengthening its impact on reducing default risk.

Table 7: Firms have more than median analyst coverage vs less than median analyst coverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High analyst coverage				**Low analyst coverage**			
Dependent Variable DD								
Massiveness	0.012***				0.008**			
	(7.956)				(2.467)			
Intelligibility		0.007***				0.005*		
		(6.116)				(1.924)		
Usability			0.006***				0.005*	
			(5.070)				(1.953)	
Information amount				0.014***				0.008***
				(9.960)				(2.589)
LNS	0.131***	0.148***	0.152***	0.115***	-0.052*	-0.044	-0.044	-0.056**
	(14.114)	(17.081)	(17.552)	(11.841)	(-1.885)	(-1.612)	(-1.619)	(-2.001)
K/S	0.728***	0.732***	0.734***	0.722***	0.930***	0.932***	0.930***	0.932***
	(17.347)	(17.435)	(17.465)	(17.201)	(8.105)	(8.119)	(8.099)	(8.116)
Y/S	4.999***	5.012***	5.009***	4.997***	5.012***	5.010***	5.008***	5.016***
	(26.829)	(26.889)	(26.869)	(26.839)	(11.470)	(11.464)	(11.458)	(11.480)
R&D/K	0.008**	0.009**	0.008**	0.008*	-0.009	-0.009	-0.009	-0.009
	(1.975)	(2.084)	(2.061)	(1.957)	(-0.824)	(-0.800)	(-0.798)	(-0.841)
RDUM	0.748	0.685	0.712	0.731				
	(1.216)	(1.114)	(1.158)	(1.190)				
I/K	-0.076***	-0.073***	-0.073***	-0.080***	-0.368***	-0.366***	-0.368***	-0.366***
	(-2.864)	(-2.733)	(-2.745)	(-2.990)	(-4.289)	(-4.263)	(-4.290)	(-4.272)
ROA	0.034***	0.034***	0.034***	0.034***	0.007	0.006	0.007	0.007
	(16.409)	(16.204)	(16.303)	(16.548)	(1.425)	(1.387)	(1.422)	(1.450)
LEVERAGE	-5.632***	-5.637***	-5.634***	-5.625***	-7.264***	-7.263***	-7.263***	-7.262***
	(-86.143)	(-86.183)	(-86.123)	(-86.078)	(-42.604)	(-42.585)	(-42.587)	(-42.595)
Age	0.059***	0.053***	0.045***	0.067***	0.191***	0.190***	0.184***	0.192***
	(3.877)	(3.493)	(2.977)	(4.428)	(5.277)	(5.241)	(5.119)	(5.309)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High analyst coverage				**Low analyst coverage**			
Dependent Variable DD								
Constant	1.768***	1.877***	1.889***	1.824***	4.870***	4.935***	4.949***	4.903***
	(2.831)	(3.007)	(3.023)	(2.927)	(16.815)	(17.170)	(17.376)	(17.239)
Observations	30248	30248	30248	30248	5672	5672	5672	5672
R-squared	0.542	0.541	0.541	0.542	0.616	0.616	0.616	0.616
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: This table presents the moderating role of external governance—proxied by analyst coverage—on the relationship between Web disclosure and DD. Columns 1-4 show results for high analyst coverage, while Columns 5-8 show results for low analyst coverage. The dependent variable is DD, proxied by Distance-to-Default. The key independent variable is Web disclosure. All models control for firm-specific characteristics. Industry and year fixed effects are included in all regressions. Robust standard errors are clustered at the firm level. T-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.*

5.3 Independent Directors

The presence of independent directors on the board serves as a critical governance mechanism, given their ability to provide objective oversight and mitigate potential conflicts of interest (Fama and Jensen, 1983). Independent directors can strengthen the credibility of corporate disclosures by ensuring that the information disseminated—both financial and non-financial—is accurate, complete, and timely. Prior research (Cheng & Courtenay, 2006; Li & Wang, 2016) documents that firms with a greater proportion of independent directors tend to engage in higher levels of voluntary disclosure, thereby reducing information asymmetry and improving market perceptions of creditworthiness. In the Japanese context, where regulatory emphasis on board independence has been increasing, we expect the positive association between web disclosure and distance-to-default (DD) to be more pronounced among firms with higher levels of board independence. We classify firms into high and low independent director groups based on the median proportion of independent directors, using data obtained from the NIKKEI CGES database.

The results, presented in Table 8, are consistent with our expectations. Across all four dimensions of web disclosure—massiveness, intelligibility, usability, and information amount—the coefficients are larger for firms with higher independent director representation, with all

estimates statistically significant at the 1% level. For example, the coefficient on massiveness is 0.017 for the high group compared to 0.010 for the low group, intelligibility is 0.010 versus 0.006, usability is 0.010 versus 0.005, and information amount is 0.017 versus 0.005. These results indicate that the presence of independent directors amplifies the beneficial effect of web disclosure on DD, suggesting that rigorous board oversight enhances transparency, mitigates default risk, and improves creditor confidence.

Table 8: Have higher independent directors' vs. have lower independent director

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	High Independent director				**Low Independent director**			
Dependent Variable DD								
Massiveness	0.017***				0.010***			
	(5.291)				(8.114)			
Intelligibility		0.010***				0.006***		
		(4.165)				(6.177)		
Usability			0.010***				0.005***	
			(3.143)				(5.679)	
Information amount				0.017***				0.005***
				(7.025)				(9.060)
LNS	0.111***	0.125***	0.131***	0.093***	0.144***	0.165***	0.165***	0.133***
	(9.372)	(11.252)	(11.869)	(7.494)	(11.086)	(13.341)	(13.284)	(10.011)
K/S	0.705***	0.709***	0.708***	0.700***	0.857***	0.858***	0.866***	0.853***
	(13.086)	(13.161)	(13.125)	(12.987)	(14.309)	(14.306)	(14.448)	(14.241)
Y/S	5.640***	5.650***	5.655***	5.632***	4.341***	4.357***	4.326***	4.350***
	(23.809)	(23.845)	(23.861)	(23.786)	(17.467)	(17.515)	(17.388)	(17.514)
R&D/K	0.011**	0.011**	0.011**	0.010**	0.009	0.009	0.009	0.008
	(2.424)	(2.510)	(2.537)	(2.365)	(1.031)	(1.075)	(1.034)	(1.001)
RDUM	1.146	1.094	1.111	1.147				
	(1.625)	(1.551)	(1.574)	(1.628)				
I/K	-0.087***	-0.084***	-0.084***	-0.089***	-0.223***	-0.213***	-0.214***	-0.224***
	(-3.035)	(-2.953)	(-2.955)	(-3.138)	(-3.509)	(-3.356)	(-3.362)	(-3.524)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High Independent director				Low Independent director			
Dependent Variable DD								
ROA	0.022***	0.021***	0.022***	0.022***	0.040***	0.039***	0.040***	0.040***
	(8.433)	(8.300)	(8.334)	(8.579)	(14.190)	(14.019)	(14.192)	(14.237)
LEVERAGE	-6.059***	-6.062***	-6.061***	-6.051***	-5.615***	-5.621***	-5.618***	-5.610***
	(-70.896)	(-70.913)	(-70.891)	(-70.832)	(-64.335)	(-64.353)	(-64.304)	(-64.302)
Age	0.090***	0.087***	0.079***	0.097***	0.059***	0.050***	0.040**	0.066***
	(4.365)	(4.203)	(3.858)	(4.712)	(3.082)	(2.611)	(2.135)	(3.458)
Constant	1.885***	1.965***	1.990***	1.911***	1.947***	2.070***	2.113***	2.011***
	(2.626)	(2.738)	(2.770)	(2.668)	(15.214)	(16.353)	(16.853)	(16.274)
Observations	19839	19839	19839	19839	16081	16081	16081	16081
R-squared	0.541	0.540	0.540	0.541	0.558	0.557	0.557	0.558
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

6. CONCLUSION

The rapid advancement of digital technologies has transformed corporate communication channels, with web-based disclosure emerging as a critical medium through which firms voluntarily disseminate timely, comprehensive, and high-quality financial and non-financial information. In Japan, this shift holds particular relevance given its distinctive ownership and corporate governance structure—characterized by stable shareholding arrangements and cross-shareholdings—that diverges markedly from the Anglo-American model. At the same time, Japanese firms face evolving risk profiles, with macroeconomic vulnerabilities amplified by the country's exceptionally high level of government debt. Despite the growing literature on web-based disclosure and its implications for corporate outcomes, evidence on its relationship with default risk—particularly in the Japanese context—remains limited.

This study addresses this gap by examining the effect of web-based disclosure on the default risk of Japanese listed firms. Using a comprehensive dataset of 35,920 firm-year observations spanning 2007–2022, and employing Merton's distance-to-default (DD) as our primary risk

metric, we find robust evidence that greater web-based disclosure is associated with a higher DD, indicating a lower probability of default. This finding is consistent with the predictions of both agency theory and signaling theory, suggesting that enhanced disclosure reduces information asymmetry, strengthens market confidence, and acts as a credible signal of firm quality.

We further investigate whether external corporate governance mechanisms—specifically institutional ownership, analyst coverage, and board independence—moderate this relationship. Across all specifications, our results indicate that the positive effect of web-based disclosure on DD is significantly stronger in the presence of higher institutional ownership, greater analyst following, and a larger proportion of independent directors. These mechanisms appear to reinforce the monitoring of managerial actions and enhance the credibility of disclosed information, thereby amplifying the risk-mitigating benefits of disclosure. Our findings remain robust to alternative default risk measures, including the Altman Z-score and CDS spreads.

The implications of our results are threefold. First, for corporate managers, the evidence underscores the strategic value of web-based disclosure as a tool for lowering default risk. Beyond its compliance and reputational benefits, an expanded and transparent disclosure policy can enhance creditor and investor confidence, limit financing costs, and reduce the likelihood of financial distress. Second, for investors, web-based disclosure provides timely and comprehensive information that reduces decision-making under uncertainty and facilitates early identification of emerging risks. Third, for policymakers, our findings highlight the importance of integrating disclosure quality into corporate governance reforms. Encouraging firms to adopt more comprehensive and accessible web-based disclosures—complemented by robust governance mechanisms—can contribute to a more resilient corporate sector and a more stable financial system.

This study has several limitations, including the exclusion of qualitative web content, which may provide additional insights into the tone and depth of corporate disclosures. Additionally, the measurement of disclosure scores may be subject to bias, as the criteria used might not fully capture the complexities of corporate disclosure practices. Furthermore, the Japan-specific institutional context restricts the generalizability of the findings, as the observed relationship between disclosure and default risk may differ in countries with varying regulatory environments and corporate governance structures. Future research could address these limitations by

conducting cross-country comparative studies to assess the broader applicability of the findings. Lastly, exploring the integration of artificial intelligence in online disclosure practices may present a promising avenue for future research.

Overall, this study provides novel empirical evidence that web-based disclosure plays a meaningful role in mitigating default risk in Japan, particularly when supported by strong external governance. These insights not only contribute to the disclosure–risk literature but also offer actionable guidance for enhancing corporate transparency and stability in an evolving global capital market environment.

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APPENDIX A1: VARIABLE DEFINITION

Variable	Definition	Source
Dependent Variable		
Distance to Default	Risk neutral distance-to-default measured by Merton (1974)	CRI
Independent Variable		
Massiveness	comprehensiveness of the website in covering various aspects of the firm's activities	NIKKEI CGES
Intelligibility	how understandable and clear the information on the website is for a member of the general public	Same as above
Usability	the ease of navigation and interaction with the website	Same as above
Information amount	the quantity and materiality of the details of the financial and non-financial information provided on the website.	Same as above
Control Variable		

APPENDIX A1: VARIABLE DEFINITION

Variable	Definition	Source
Dependent Variable		
LNS	The natural log of sales, used to measure firm size	DataStream
K/S	The ratio of tangible, long-term assets (property, plant, and equipment) to sales, used to measure the mitigation of agency problems as it can be stated that these assets can be monitored easily and provide proper collateral	DataStream
Y/S	The ratio of EBITDA (earnings before interest, tax, depreciation, and amortization) to sales	DataStream
R&D/K	The ratio of research and development expenditures to property, plant, and equipment. We set missing observations of R&D/K equal to zero to maintain sample size	DataStream
RDUM	A dummy variable equal to one if R&D data are available, and zero otherwise. This variable allows the intercept term to capture the mean of R&D/K for missing values	DataStream
I/K	The ratio of capital expenditures to property, plant, and equipment	DataStream
ROA	Net income before extraordinary items and discontinued operations divided by total assets multiplied by 100	DataStream
Leverage	Long-term debt divided by the book value of total assets	DataStream
Age	One plus the listing age of a firm as measured by the number of years from its IPO as reported in CRSP	DataStream

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Taskin Shakib is an academic, entrepreneur, and finance professional with over a decade of national and international experience in consulting, research, corporate finance, and startups. He has taught courses in Financial Management, Investment Analysis, and Strategic Finance, integrating his practical experience with academic rigor. As an Investment Analyst in the Sustainable Investment Cell of the Central Bank of Bangladesh, he managed PPP-based infrastructure projects worth $600 million, primarily funded by the World Bank, and led $6 million in sustainable investment projects in agriculture. His research roles with USAID and the World Bank focused on diaspora investment and trade competitiveness. Taskin is also the co-founder of Sentinel Technologies, Bangladesh's most innovative tech company of 2023, which is building the country's EV charging infrastructure through its brand, Ekhon Charge. His

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Humaira Haque is a Senior Lecturer in the Department of Accounting and Finance at North South University, Bangladesh. Her research focuses on corporate governance, ESG, nature dependance, ownership structure, capital structure and its linkage with different determinants to measure firm performance and credit risk. She has published in leading international journals, including Journal of Risk and Financial Management and China Accounting and Finance Review (ABDC A). The article published in China Accounting and Finance Review is the first to investigate the effect of insider ownership on default risk in a Japanese setting. Insider ownership enhances the probability of default. Hence, policymakers may consider instituting a ceiling for insider ownership in Japanese firms. Her recent studies investigate the interplay between diversity and inclusion and corporate social responsibility, carbon emission, ownership structures

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