The Impact of XBRL Adoption on the Information Environment

Evidence from Japan

ABSTRACT

This article investigates whether the Japanese Financial Services Agency's mandatory use of XBRL affects investors in assessing the financial information. Although regulators expect the introduction of XBRL to enhance the transparency and quality of business reporting, given the non-trivial implementation and learning costs, whether the XBRL-based disclosure improves the information environment is an empirical question. As prior studies in other countries provide mixed results, our analysis of the Japanese case should be quite insightful, because Japan is one of the few countries where thousands of listed firms were forced to use the XBRL format all at once. By examining various measures in the pre- and post-XBRL periods, we provide evidence consistent with the notion that the adoption of XBRL has helped to improve the information environment, as shown by the reduction of event returns volatility, absolute cumulative abnormal returns, changes in the standard deviation of returns, and abnormal bid-ask spread.

Keywords: XBRL; information asymmetry; capital market; event study

Data availability: All data used in this study is publicly available.

1. Introduction

The eXtensible Business Reporting Language (XBRL) is under fast transition from the vision phase to becoming a practical global standard for financial and business reporting. XBRL is aimed to allow efficient compilation, distribution, and usage of financial statements. It is an open standard that provides a way to model business information and to articulate its semantic meaning.[1] Internationally, the XBRL data standard is a platform for addressing the problem of data integrity, timeliness, and reusability. In Asia, stock exchanges in China, Japan, Singapore, and South Korea have all mandated the use of XBRL data.[2] In April 2009, the U.S. Securities and Exchange Commission (SEC) mandated that listed firms report their financial statement data using XBRL, with the goal of using XBRL as a binding and exclusive format in the U.S. in the future. As of 2011, there were 50 XBRL projects in 15 European countries that were established or in progress.[3]

A considerable amount of research related to XBRL has been carried out over the last decade, with a significant increase in related publications in recent years. Among them, research on the effects of the adoption and diffusion of XBRL on capital markets is one of the more emphasized areas. Several studies provide evidence that the introduction of XBRL reduces information asymmetry (Tan and Shon 2009; Efendi et al. 2010; Yoon et al. 2011; Kim et al. 2012), while more recent research provides contradicting results (Blankespoor et al. 2012).

As prior studies provide mixed results, the question of whether the use of XBRL helps to improve the information environment in capital markets is left as an empirical question. The present study aims to contribute to related literature by examining the Japanese data. We believe that investigation of the Japanese case should provide useful empirical results, because Japan is one of the few countries where approximately 5,000 listed firms and 3,000 funds were forced to use the XBRL format at the same time (Kobayashi 2008).[4]

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[1] According to the U.S. SEC, the use of XBRL will allow investors and analysts to "capture and analyze information more quickly and at less cost than is possible using the same financial information provided in a static format" (SEC 2009).

[2] China had the first capital market to adopt XBRL. In 2004, the China Securities Regulatory Commission, the Shanghai Stock Exchange and the Shenzhen Stock Exchange, mandated all publicly traded firms to file their financial statement using XBRL as part of their effort to increase the overall attractiveness of the Chinese equity markets (Peng et al. 2011).

[3] Among the projects in Europe that involved mandatory filings are those by the U.K. Companies House, Belgium's National Bank, banking industry and government in Spain, Danish Commerce and Companies Agency, and Italy Infocamere (ISARG 2011).

[4] While the U.S. SEC employed a phase-in period to adopt XBRL, Japan's EDINET introduced the official XBRL mandate in 2008 after two pilot projects in which about 50 of the filing companies chosen by the FSA tested the taxonomies in the 1st project and 1,223 firms voluntarily participated in the 2nd project. It is true that the phased adoption (such as in the US) enables researchers to have a control sample that do not employ XBRL, while we cannot have such a control sample as all listed firms in Japan were forced to employ XBRL all at once. However, the phrased adoption may cause difficulty in isolating the effects of the XBRL adoption

Compared to Japan, research on other countries covers a relatively small number of observations. For instance, the U.S. SEC required large accelerated filers (approximately 500 firms)[5] to disclose their financial information in the XBRL format in 2009, although more than 10,000 listed firms were required to do so after December 2011. The prior study of the Korean implementation of XBRL use investigates 550 listed firms (Yoon et al. 2011), while the study of the Chinese case covers about 1,300 listed firms per year (Peng et al. 2011).

Japan has been an early and active adopter of XBRL. [6] The XBRL Japan organization was established as far back as April 2001 to help promote and create awareness of XBRL within the country. Since the latter half of the 2000s, XBRL has been adopted and used in production by key governmental and public organizations (Hoffman and Watson 2010), including the Financial Systems and Bank Examination Department of the Bank of Japan (BOJ), the National Tax Agency of Japan (NTA), the Tokyo Stock Exchange (TSE), and the Financial Services Agency (FSA).

The FSA has an Electronic Disclosure for Investors' Network (EDINET) system and all listed firms and investment funds in Japan are required to file their disclosure documents using the system. The FSA launched a new EDINET system in preparation for the adoption of XBRL in 2008. All filers are mandated to submit the financial statements for fiscal years starting in or after April 2008 in the XBRL format. The XBRL mandate is part of the FSA's continuing efforts to use XBRL to achieve multinational interoperability together with the International Accountings Standards Committee Foundation and the U.S. SEC.

The adoption of XBRL in the new EDINET system is expected to enable investors to download financial data and directly process and analyze the data. If the use of XBRL is successful in reducing information processing costs and information asymmetry, the introduction of XBRL may not only assist in enhancing the transparency of the securities market but also improve the information structure in ways that will enhance the efficiency of economic and social activities in general.

The purpose of this paper is to examine whether the FSA's mandatory financial reporting using XBRL has affected investors in assessing financial information. Specifically, we investigate the effects of using XBRL on the information environment in the Japanese market by assessing various measures in the pre- and post-XBRL periods. Our results are consistent with the notion that the adoption of XBRL helps to improve the information environment in the Japanese market, as shown by the reduction of event returns volatility, absolute cumulative abnormal return, change in standard deviation of return, and

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from the effects of other economic events, occurring at different times, while the one-time adoption requires us to consider only the effects of the events occurring at the same time.

[5] Specifically, the large accelerated filers here means those using U.S. GAAP with a worldwide public float over $5 billion.

[6] Detailed description on the XBRL adoption in Japan is provided in Appendix 1.

abnormal bid-ask spread.[7]

The rest of this article is organized as follows. Section 2 provides a literature review and hypothesis development. Section 3 describes the data and methodology used in the research. Sections 4 and 5 discuss the empirical results and robustness tests, respectively. Lastly, Section 6 provides a conclusion for the paper.

2. Literature review and hypothesis development

2.1 Literature review

A considerable amount of research related to XBRL has already been carried out over the last decade, with a significant increase in relevant publications in recent years.[8] According to Mike Starr from the U.S. SEC, the main benefits of using XBRL are more timely access and greater transparency for investors and enhanced efficiency in analyzing the data by the regulator, both of which will result in a more effective regulatory process (Starr 2012). Both the market and companies stand to benefit from this gained transparency as investors appreciate having more information about the company readily available.[9] This improved, transparent, and real-time financial reporting and disclosure of data in the XBRL format is expected to reduce each participating firm's cost of capital (Pinsker and Li 2008).[10]

One drawback is that the large setup and learning costs of implementing XBRL

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[7] One may argue that the timing of XBRL-adoption was so close to the world financial crisis in 2008 that may make it difficult to isolate the effects of XBRL from the effects of the world financial crisis. However, we can reasonably assume that the financial crisis may increase uncertainty and information asymmetry, while the XBRL adoption is expected to reduce information asymmetry, which is consistent with our results.

[8] The increased efforts related to the use of XBRL by the U.S. SEC together with the availability of the first empirical data from real XBRL-based financial reports from 2008 may have been a significant driving force to explain the increase in XBRL publications in recent years (Roohani et al. 2010).

[9] The increased transparency by the use of the XBRL may also improve the corporate governance of filers. For instance, Peng et al. (2011) examine the level of total accruals that firms report before and after the XBRL adoption in China. Their results indicate lower level of total accruals in the post-XBRL period, with this effect most prominent for high-growth firms, small firms, and firms in high-technology industries. They argue that XBRL implementation decreases an investor's information acquisitions costs and improves an investor's ability to detect earnings management. Accordingly, managers are pressured to reduce accruals. In addition, Premuroso and Bhattacharya (2008) examine whether early and voluntary filers of financial information in XBRL format demonstrate superior corporate governance and operating performance relative to their non-adopting peers. The results of their study suggest that early and voluntary XBRL adoptions are indeed indicators of superior corporate transparency and related corporate governance that are expected to benefit adopting firms in the long run.

[10] Another advantage of using XBRL tags is that otherwise unused information in the notes becomes more usable. Henselmann and Scherr (2012) develop an automated content analysis technique to assess the bankruptcy of companies using XBRL tags. A list of potential red flags based on the U.S. Generally Accepted Accounting Principles (GAAP) taxonomy is developed based on the annual reports of 26 companies with Chapter 11 bankruptcy filings and a control group. The empirical results reveal that the red flag item list has predictive power of bankruptcy risk. Logistic regression results also showed that the predictive power increases as the bankruptcy filing date approaches.

reporting may deter both filers and investors from using XBRL. Because of its complicated technology, the introduction of XBRL may involve many difficulties, resulting in an increase of preparation cost. In fact, the U.S. committee on corporate reporting of Financial Executives International also expressed its concerns that requiring filers to adopt XBRL would result in increased costs with no improvements to internal processes (Dzinkowski 2008). In addition, prior studies cast doubt on the reporting quality of XBRL, as errors or incompleteness of financial reporting are still observed (Zhu and Fu 2009; Debreceny et al. 2010; Bartley et al. 2011; Roohani and Zhen 2011).[11]

These shortcomings raise the issue of whether the information environment (asymmetry) is improved (reduced) by the introduction of XBRL. One of the important factors that will allow us to answer this question is whether the accessibility of financial information is improved by the introduction of XBRL. From the viewpoint of investors, a unique aspect of the XBRL mandate is that it requires investors to incur significant setup costs to achieve the intended benefits. Thus, those that perceive the costs to outweigh the benefits may decide to forego or delay the use of XBRL. For example, investors with relatively fewer resources may refrain from the use of XBRL until they have a better understanding of the associated costs and it is likely that only a subset of investors will choose to use XBRL in the initial year of mandate.

A couple of prior studies examine whether the use of XBRL can help investors to acquire financial information based on experimental methodology (Hodge et al. 2004; Pinsker and Wheeler 2009). Hodge et al. (2004) employ experimental research and examine whether using an XBRL-enhanced search engine helps nonprofessional financial statement users acquire and integrate related financial information when making an investment decision. Their results suggest that XBRL should be beneficial for the users by improving the transparency of firms' financial statement information, although nonprofessional users may not automatically use XBRL, as half of their experimental participants with access to XBRL technology do not use the technology.

Pinsker and Wheeler (2009) complement the findings of Hodge et al. (2004) by investigating the relationship between XBRL use and perception by surveying 61 MBA students as proxies for nonprofessional investors. Their results indicate that nonprofessional investors who use XBRL-formatted information have more accurate perceptions of analytical effectiveness and efficiency in utilizing XBRL-based information as compared to paper-based investors performing non-directed analysis.

Although the experimental studies suggest the improved accessibility of financial information following the introduction of XBRL, other prior studies provide mixed results regarding whether the introduction of XBRL is associated with the reduction of information asymmetry (Tan and Shon 2009; Efendi et al. 2010; Yoon et al. 2011; Kim et al. 2012; Blankespoor et al. 2012). Tan and Shon (2009) report that U.S. firms that voluntarily file in the XBRL format enjoy reduced information asymmetries in the form of reduced bid-ask

[11] The literature review on the reporting quality of XBRL is presented in Appendix 2.

spreads. They also find that smaller firms, whose information environment may be poor, are more likely to attract more analysts after they decide to file in the XBRL format.

Efendi et al. (2010) show significant price movement on the date of voluntary XBRL filings in the U.S. They argue that XBRL conveys incremental value-relevant information about the market due to ease of comparability and predictability, enhancing the relevance of financial reports. They also document that smaller investors benefit more due to reduced costs associated with information processing and analysis from the adoption of XBRL. While Tan and Shon (2009) and Efendi et al. (2010) examine the effect of voluntary disclosure, Kim et al. (2012) investigate the impact of mandatory XBRL reporting and find an increase in information efficiency, a decrease in event return volatility, and a reduction of change in stock returns volatility for 425 U.S. mandated filers in the post-XBRL adoption period.

Yoon et al. (2011) deal with the question of whether the mandatory use of XBRL may reduce the information asymmetry in the Korean Stock Market. Their results demonstrate the presence of a significant and negative association between XBRL adoption and information asymmetry, which implies that the adoption of XBRL may lead to the reduction of information asymmetry. In addition, the effect of XBRL adoption on reducing information asymmetry is more prominent for large firms than for small- and medium-sized firms in Korea.

More recently, however, Blankespoor et al. (2012) examine the initial impact of the use of XBRL on information asymmetry after the U.S. SEC mandate. They provide evidence of a higher abnormal bid-ask spread, a reduction in abnormal liquidity, and a decrease in abnormal trading volume for XBRL-adopting firms around 10-K filings. As a conclusion, they claim that the SEC's objective of improving the information playing field might not have been met during the initial year of XBRL adoption.

2.2 Hypothesis development

As discussed above, XBRL is an internationally standardized computer language aimed at allowing the efficient compilation, distribution, and usage of financial statements. It is an open standard that provides a way to model business information and to articulate its semantic meaning. The adoption of XBRL could enable investors to download financial data and directly process and analyze the data. In addition, the introduction of XBRL may not only assist in enhancing the transparency of the securities market but also improve the information structure in ways to enhance the efficiency of economic and social activities in general.

However, given the non-trivial implementation and learning costs involved in the adoption of XBRL, whether the XBRL-based disclosure improves (reduces) the information environment (asymmetry) is left as an empirical question. We set the null hypothesis as follows:

H0: *The XBRL disclosure does not affect the information environment (asymmetry)*

around annual securities filing dates.

As discussed in the previous subsections, prior studies provide mixed results on whether the use of XBRL helps improve information environment in capital markets. We believe that investigation of the Japanese case could contribute to the related literature by providing useful empirical results based on the large number of sample firms that started to disclose financial statements by using the XBRL format all at once. In the following sections, we investigate the effects of the mandatory XBRL requirement on the information environment around the annual securities filing by using data on firms listed in the first section of the TSE.[12]

3. Research design and data

3.1 Information environment measures

To examine the impact of the XBRL mandate on the information environment in the Japanese market, we employ several measures that are used in prior studies. Specifically, we focus on five measures, including event returns volatility (ERV), absolute cumulative abnormal returns (ACAR), the change in standard deviation of daily stock returns (ΔSTDDEVRET), abnormal bid-ask spread (ASPREAD), and abnormal trading volume (AVOL). A summary of variable definitions is presented in Appendix 3.

The first two measures are calculated by using abnormal returns (ARs) based on the event study. To estimate ARs, we employ the standard event study methodology based on MacKinlay (1997). The event here is defined as the day when the firm submits its annual securities reports. AR is defined as the actual ex post return of the security over the event window, the period in which the market is considered to be affected by the event, minus the expected return of the security over the event window, as follows:

$$AR_{it} = R_{it} - E(R_{it}|X_t) \tag{1}$$

where AR_{it}, R_{it}, and $E(R_{it}|X_t)$ are the abnormal, actual, and expected (normal) returns, respectively, for firm i at period t. X_t is the conditioning information for the expected return.

To calculate the expected return, we estimate the standard market model over the estimation window, the period in which the market is not affected by the event. The market model assumes a stable linear relation between the return of any given security and the return of the market portfolio. Denoting R_{mt} as the market return, the market model is expressed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{2}$$

$$E(\varepsilon_{it} = 0) \qquad var(\varepsilon_{it}) = \sigma_\varepsilon^2$$

[12] The TSE has two sections. Larger and more established firms are supposed to be listed in the first section.

where ε_{it} is the zero mean disturbance term. Here, α_i and β_i are the parameters of the market model. We use the Tokyo Stock Price Index (TOPIX) as our market portfolio, because TOPIX tracks all firms listed on the first section of the TSE. Our estimation window is set at one year before the annual securities report filing dates, namely, 200 trading days from day t = -255 to day t = -55 (Figure 1). Our event window is set around the annual securities filing date from day t= -1 to day t= +1.

(Figure 1 here)

We then calculate the five measures that capture the information environment. The first measure is ERV. Following prior studies (Baily et al. 2003; Heflin et al. 2003; Francis et al.; 2006; Kim et al. 2012),[13] ERV is defined as an arithmetic sum of the absolute values of ARs over the event window, as follows:

$$ERV = \sum_{t=-1}^{1} |AR_t|. \quad (4)$$

Because AR indicates the gap between the full information, post-event stock return and the expected return based on parameters estimated by using pre-event returns, ERV is also regarded as the information gap, which measures the value of information that is not reflected in the stock price prior to the filing date. A smaller ERV implies a market environment with lower information asymmetry.

The second measure is ACAR, which is calculated by the Cartesian product of ARs in the event window, following Heflin et al. (2003) and Kim et al. (2012), as follows:

$$ACAR = |\prod_{t=-1}^{1}[1 + AR_t] - 1|. \quad (5)$$

Similar to ERV, ACAR captures the gap between the full information, post-event stock price and a pre-event price, by taking the absolute deviation between the actual return and the expected return. A higher ACAR indicates a larger information gap and higher information asymmetry between informed and uninformed investors. Conversely, a smaller ACAR demonstrates a smaller deviation, which implies improved information environment.

The third measure is ΔSTDDEVRET. Following Kim et al. (2012), ΔSTDDEVRET is defined as the change in the standard deviation of daily stock returns before and after the firm's annual securities report filing dates. The construction of this variable is carried out by first calculating the standard deviation of returns using daily return data for 30 days before the annual securities report filing dates followed by calculating the standard deviation of returns for 30 days after the annual securities report filing dates, as follows:

$$\Delta STDDEVRET = \sqrt{\frac{1}{30}\sum_{t=0}^{30}(R_t - \bar{R}_t)^2} - \sqrt{\frac{1}{30}\sum_{t=-30}^{0}(R_t - \bar{R}_t)^2}. \quad (6)$$

[13] Baily et al. (2003), Heflin et al. (2003), and Francis et al. (2006) investigate the impact of the Regulation Fair Disclosure (Reg FD) on the information environment. Reg FD prohibits firms from privately disclosing value-relevant information to professional investors without disclosing the same information to the public at the same time.

ΔSTDDEVRET indicates the frequency of information reaching the market and the extent of information asymmetry among investors. As a result, we expect a reduction in the change in the standard deviation if the adoption of XBRL decreases the information asymmetry.

The fourth measure is ASPREAD, which is defined as the difference between the average daily bid-ask spread between the event window (post-event period) and the estimation window (pre-event period). Following prior studies (Yoon et al. 2011; Blankespoor et al. 2012), ASPREAD is expressed as follows:[14]

$$ASPREAD = Average\ daily\ spread_{Event\ window} - Average\ daily\ spread_{Estimation\ window}. \quad (7)$$

The bid price is quoted by buyers and the ask price is quoted by sellers for a given security. Information asymmetry increases together with bid-ask spread. Thus, if the XBRL mandate decreases information asymmetry, we predict a smaller bid-ask spread in the event window than that in the estimation window. In other words, the adoption of XBRL is likely to decrease ASPREAD.

The last measure is AVOL. Following prior studies (Baily et al. 2003; Francis et al. 2006; Miller 2010; Blankespoor et al. 2012), AVOL is defined as the difference between the mean daily trading volume during the event window and the mean daily trading volume during the estimation window, divided by the standard deviation (STDDEV) of daily trading volume during the estimation window, as follows:

$$AVOL = \frac{Average\ daily\ volume_{Event\ window} - Average\ daily\ volume_{Estimation\ window}}{STDDEV\ daily\ volume_{Estimation\ window}} \quad (9)$$

Investors are not able to fully process all available information due to limited time and resources. As such, information to be processed is selectively chosen. If the XBRL filings are relatively less difficult to process, investors will find more incentives to process them, as the costs required may be less than the benefits of obtaining the information. In other words, investors should be more willing to trade in such an environment. Thus, if the adoption of XBRL decreases information processing costs, we expect larger average daily volume in the event window than that in the estimation window. In other words, we expect the increase of AVOL in the post-XBRL period.

3.2 Multivariable regression models

Using variables described above, we estimate the following regression models to assess the effects of XBRL adoption on the information environment in Japan:

[14] To calculate the bid-ask spread, we follow Corwin and Schultz (2012) and use a bid-ask estimator developed from daily high and low prices.

$$ERV = \alpha_0 + \alpha_1 XBRL + \alpha_i \sum_{k=i}^{n} CONTROLS + \epsilon \quad (10)$$

$$ACAR = \alpha_0 + \alpha_1 XBRL + \alpha_i \sum_{k=i}^{n} CONTROLS + \epsilon \quad (11)$$

$$\Delta STDDEVRET = \alpha_0 + \alpha_1 XBRL + \alpha_i \sum_{k=i}^{n} CONTROLS + \epsilon \quad (12)$$

$$ASPREAD = \alpha_0 + \alpha_1 XBRL + \alpha_i \sum_{k=i}^{n} CONTROLS + \epsilon \quad (13)$$

$$AVOL = \alpha_0 + \alpha_1 XBRL + \alpha_i \sum_{k=i}^{n} CONTROLS + \epsilon \quad (14)$$

where XBRL is a dummy variable, which takes one if the annual securities filing date is in the post-XBRL period and zero otherwise. CONTROLS presents control variables that are likely to be associated with the information environment. XBRL is our primary variable of interest. If the adoption of XBRL improves the information environment, we expect XBRL to be negatively correlated with ERV, ACAR, △STDDEVRET, and ASPREAD, and positively correlated with AVOL, as explained in the previous sub-section.

CONTROLS are included to ensure that our results are not driven by other firm-specific characteristics that may affect the information environment. Specifically, CONTROLS include firm size (SIZE), market-to-book ratio (MB), earnings to profit ratio (EPRATIO), leverage (LEV), loss indicator (LOSS), the IT & Services sector (TECH), percentage of shares held by foreign shareholders (GOV), return volatility for the estimation window (RETVAR), indicator of the negative sign of the cumulative AR (NEGCAR), and cumulative absolute AR for the corresponding quarter (CAAR).

Prior research has shown that there is a positive correlation between a firm's extent of disclosure and its size (Ajinkya et al. 2005). We include SIZE, which is the natural log of market capitalization at the end of the corresponding fiscal year. Considering larger firms' ability to sustain a comparative advantage through superior financial and human resources available, we expect negative correlation between SIZE and information asymmetry.

MB is defined as the ratio of the firm's market capitalization to the total equity at the end of the fiscal year. MB is included to capture the perceived potential growth in the market. We also include EPRATIO of the firm at the end of the fiscal year as a proxy for expected growth in earnings, as prior research argues that growth expectations increase stock price responses to earnings (Skinner and Sloan 2002). Because high-growth firms are likely to have higher information asymmetry, we expect positive correlation between MB/EPRATIO and information asymmetry.

Firms operating at higher leverage generally have higher financial risks, and they tend to be inclined to disclose more financial information to provide assurance to creditors and confidence to the public (Kothari et al. 2009). As a result, we include LEV, which is defined as the ratio of long-term debt divided by total assets at the end of the fiscal year. In addition, prior research has shown that financial reporting errors are negatively correlated with performance and that the presence of a net income loss impedes the market's ability to accurately forecast the firm's earnings (Heflin et al. 2003). To control this negative effect,

we employ a dummy variable LOSS, which is equal to one if the net income in the corresponding fiscal year is negative and zero otherwise. Based on the explanations above, we expect negative (positive) correlation between LEV (LOSS) and information asymmetry.

We also include an industry dummy variable TECH for technology firms, which is equal to one for firms that are classified under IT & Services and zero otherwise. Technology firms usually exhibit financial statements that are more difficult to interpret due to financial reporting models that may not properly capture value-relevant information related to intellectual property and R&D activities. We expect positive correlation between TECH and information asymmetry. GOV is a percentage of shares held by foreign shareholders as a proxy for corporate governance. As foreign shareholders are expected to be more demanding for disclosure in Japan than domestic shareholders, firms with a high foreign shareholders ratio are expected to face less information asymmetry.

The last three variables are related to price variability, which may increase information asymmetry. RETVAR controls for firm-specific inherent price variability, which is defined as the standard deviation of the firm's ARs during the market model estimation window for the corresponding annual securities filing date. We expect RETVAR to be positively related to information asymmetry (Beaver 1968). NEGCAR is a dummy variable, which takes 1 if cumulative ARs during the estimation window are negative and 0 otherwise. NEGCAR controls for another dimension of price variability. Prior studies suggest that downward price movements are greater than upwards price movements (Heflin et al. 2003). Lastly, CAAR, which is a cumulative absolute AR around the filing date from t=-30 to t=+30, is included. CAAR measures the total information flow, and firms with larger information flow are expected to have larger information gaps at any given time. We expect this variable to be positively correlated with information asymmetry (Heflin et al. 2003).

3.3 Sample Selection

We download all of the firms listed in the first section of the TSE from the TSE's homepage to obtain 1,685 domestic firms as of May 31, 2012. The FSA has its own EDINET code to uniquely label firms found in its EDINET database. The corresponding EDINET code is first located from the FSA's homepage. Then, a list of filing dates for the annual securities reports is downloaded from the Ullet website (*http://www.ullet.com*)[15] for all the firms between January 1, 2007, and June 30, 2009. (This is similar to Form 10-K required by the U.S. SEC.) Data related to financial statements, such as net income, total long-term debt, total assets, and total debt are also downloaded from the Ullet website. Data with respect to stocks, which include high price, low price, closing price, opening price and volume, are downloaded from Yahoo! Finance Japan. Lastly, the number of shares outstanding for each firm is obtained from Nikkei NEEDS-Financial Quest.

[15] Ullet is a web service by Businesswire (a Berkshire Hathaway company), which organizes financial data of about 4,000 companies listed on the stock markets in Japan. The information provided by Ullet is compiled from the Japanese FSA EDINET database.

After accounting for incomplete data and matching requirements, we have 2,276 annual securities filing dates from 1,138 firms. These securities filing dates are matched for each of the 1,138 firms to allow a more accurate comparison between the pre-XBRL and post-XBRL period (1,138 annual securities filing dates for the pre-XBRL period and the post-XBRL period). We set the period between January 1, 2008, and June 30, 2008, as the pre-XBRL period, and the period between January 1, 2009, and June 30, 2009, as the post-XBRL period. As most Japanese firms have their fiscal year ending on March 31, the majority of annual securities filing dates of the sample are found in June.

Table 1 shows the number of the firms in our sample broken down by TOPIX Sector Code. The sample has a large representation from Construction & Materials, Raw Materials & Chemicals, Electrical Appliances & Precision Instruments, and IT & Services, Others. However, these industries each account for only approximately 10 percent of the total sample. Overall, the sample is well distributed across several broad industry groups. This broad representation should alleviate concerns that the results are driven by any specific industry.

(Table 1 here)

4. Empirical results

4.1 Descriptive statistics

Table 2 presents the descriptive statistics of the sample firms' characteristics before and after the adoption of XBRL. This table provides the median, mean, and t-stat mean differences of the five measures for the information environment (ERV, ACAR, △ STDDEVRET, ASPREAD, and AVOL) and CONTROLS. If the adoption of XBRL allows users to compare XBRL-tagged data across various organizations more effectively than before, we predict an improvement in the information environment through the reduction of information asymmetry.

(Table 2 here)

Among five measures, we find a significant decrease in ΔSTDDEVRET and ASPREAD after the adoption of XBRL. These results are consistent with the notion that the introduction of XBRL tends to decrease information asymmetry, although we find no significant difference in ERV, ACAR, or AVOL.

Among the control variables, SIZE, MB, EPRATIO, LEV, LOSS, GOV, RETVAR, and CAAR are significantly different between the pre-XBRL and post-XBRL periods at the 1 percent level. We note that the means of the variables related to the financial health of the firms deteriorate in the post-XBRL period, as can be seen from the lower EPRATIO, and higher LEV and LOSS. Similarly, SIZE, MB, and GOV decrease in the post-XBRL period and differ at the 1 percent significance level. The deterioration of financial health and governance of firms may be partially attributed to the 2008 financial crisis, which had a huge and negative impact on firms and the stock markets. Lastly, RETVAR and CAAR increase in the post-XBRL period and differ at the 1 percent significance level.

Table 3 provides the Pearson correlation matrix among the variables used in the regression. The highest correlation among the independent variables is 0.622, which is the correlation between SIZE and GOV. The second highest correlation is 0.525, which is the correlation between XBRL and RETVAR. Despite the relatively high correlations in these two areas, the rest of the correlations among the independent variables are below 0.5. The Variance Inflation Factor (VIF) is also calculated to confirm the absence of multicollinearity (Table 4).[16] A general guide is that multicollinearity is high when VIF > 5. As all the calculated VIF values are below 2, the absence of multicollinearity could be confirmed.

(Tables 3 and 4 here)

4.2 Regression results

Table 5 shows the multivariate regression results for the effects of XBRL on the information environment in the Japanese market. Models 1 to 5 use ERV, ACAR, ΔSTDDEVRET, ASPREAD, and AVOL as dependent variables, respectively, based on equations (10) to (14). For Models 1 to 4, the coefficients of XBRL are significantly negative at the 1 percent level, although the coefficient of XBRL is not significantly different from zero for Model 5. The significantly negative correlation between XBRL and the four measures (ERV, ACAR, ΔSTDDEVRET, and ASPREAD) are consistent with the notion that XBRL adoption improves the information environment by reducing information asymmetry.

(Table 5 here)

Our result for Models 1 to 4 shows similar benefits from the adoption of XBRL as those reported in prior studies, including those by Tan and Shon (2009), Yoon et al. (2011), and Kim et al. (2012). However, our result for Model 5 supports neither the notion that investors have incentives to trade more actively in an XBRL environment, nor the results of Blankespoor et al. (2012), which show a decrease of AVOL after the adoption of XBRL. [17]

The results for control variables are mixed, however. First, the coefficients of SIZE are significantly negative for Models 1 and 4, significantly positive for Model 3, and insignificant for Models 2 and 5. In other words, our results are mixed with regard to the

[16] This factor is calculated with a three-step process. The first step involves running an ordinary least regression on each control variable as a function of all other explanatory variables to obtain a coefficient of determination of the regression equation. The second step involves calculating the VIF factor for each control variable using the formula $VIF = \frac{1}{1-R^2}$. The final step is to analyze the magnitude of multicollinearity by considering the size of the VIF values.

[17] We also note that the adoption of XBRL brings about benefits similar to those of the Regulation Fair Disclosure (Reg FD) mandate enacted in the U.S. in 2000. Our results show that the XBRL mandate in Japan helps to reduce ACAR and ERV in the post-XBRL period, as seen from the negative coefficient of XBRL in both regressions. This is consistent with the results for the impact of the mandate of Reg FD (Heflin et al. 2003; Bailey et al. 2003).

size effect, because the results for Models 1 and 4 are consistent with our prediction that larger firms tend to have lower information asymmetry, while those for Model 3 are not.

As for the effect of potential growth on information asymmetry, the results for MB are also mixed, with significantly positive coefficient for Model 1, a significantly negative coefficient for Model 3, and insignificant coefficients for Models 2, 4, and 5. The result for Model 1 is consistent with our prediction, while those of other results are not. In addition, the coefficients of EPRATIO are not different from zero for any of the models.

The results for LEV are mixed, with significantly positive coefficients for Models 1 and 2, significantly negative coefficient for Model 3, and insignificant coefficients for Models 4 and 5. The result for Model 3 is consistent with our expectations, while the other results are not consistent with our expectations. Likewise, the coefficient of LOSS is significantly positive for Model 1, while it is insignificant for the other four models.

With regard to the industry effect, the coefficient of TECH is significantly negative only for Model 4, which is not consistent with our prediction. Regarding the effect of the shareholder composition, the coefficient of GOV is significantly negative only for Model 5, which is not consistent with our prediction, while it is insignificant for the other four models.

The remaining variables also provide mixed results: The coefficients of RETVAR are significantly positive for Models 1 and 2, insignificant for Model 3, and significantly negative for Models 4 and 5; the coefficients of ACAR are significantly negative for Models 1, 2, and 4, and insignificant for Models 3 and 5; and the coefficients of CAAR are significantly positive for Models 1, 2, 4, and 5, and insignificant for Model 3.

Although we do not obtain consistent results for control variables, all models in our regression analysis show the reduction of information asymmetry and then improvement of the information environment in the Japanese market. In the next section, we conduct two sensitivity analyses to guarantee robustness of our main results regarding measures of the financial information environment.

5. Sensitivity analysis

In this last section, we conduct two sensitivity analyses. We note that the stock market was very volatile for the period including the implementation of XBRL because of the financial crisis in 2008. The inclusion of firms in the financial industry may bias our results, because those firms are likely to have suffered a great deal during our test period. We rerun the regression of all the models in Table 6 after eliminating Banks and Financial Industry firms (codes 15 and 16 in Table 1). After eliminating these firms, our results are qualitatively similar to those in Table 5. Our main coefficients of XBRL remain negative and significant at the 1 percent level for Models 1 to 4.

(Table 6 here)

Second, we try different periods for comparison. Specifically, we collect data for 2 years prior to the adoption of XBRL by the FSA. We use the same research design to carry out the multiple regression analyses to verify whether the results are the same. In this context, we use January 1, 2007, to June 30, 2007, as the pre-XBRL period and January 1, 2008, to June 30, 2008, as the post-XBRL period. Table 7 shows the results of the multiple regression analysis. The coefficients of XBRL are significantly positive for Models 2 and 4, insignificant for Models 1 and 5, and significantly negative for Model 3. These results are contrary to our original results in Table 5, which indicates that XBRL adoption reduces information asymmetry. Thus, we can conclude that no consistent market-wide effects are observed that help to reduce information asymmetry in the TSE during this different period. This sensitivity analysis supports the notion that the improvement of the information environment can be attributed to the adoption of XBRL.

(Table 7 here)

6. Concluding remarks

In 2008, the Japanese FSA mandated that firms be required to submit their annual securities reports to the EDINET in the XBRL format. The FSA believes that this new search-facilitating technology will enhance the transparency and quality of business reporting, and improve the information environment in the Japanese market. However, given the non-trivial implementation and learning costs involved in the adoption of XBRL, whether the XBRL-based disclosure improves the information environment is basically an empirical question. In the present study, we investigate the effects of the mandatory XBRL requirement on the information environment around the annual securities filing by using data on firms listed in the first section of the TSE.

Our regression results provide evidence consistent with the notion that XBRL adoption improves the information environment in the Japanese market. This can be seen from the highly significant and negative associations between XBRL adoption and event returns volatility, absolute cumulative abnormal returns, changes in the standard deviation of returns, and abnormal bid-ask spread after controlling for firm-specific characteristics. Our findings suggest that XBRL disclosures have the potential to reduce information asymmetry through improved accessibility and transparency. These findings are robust to a sensitivity analysis excluding financial firms.

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Appendix 1: Japan setting

Japan was an early and active adopter of the XBRL. One of the earliest adopters of XBRL was the NTA, which announced an e-Tax filing system using XBRL 2.0 as the filing format in 2003 and began accepting XBRL 2.1 filings in 2008 (Sakuta 2008). The introduction of XBRL by the NTA also allowed unlisted companies to utilize XBRL. For example, small and medium-sized companies can reuse their XBRL-based financial statements, which they used for tax filings online to take loans from banks. In February 2006, the Financial Systems and Bank Examination Department of the BOJ developed a new data transfer scheme based upon the latest XBRL technology, Formula Link, to improve the efficiency of gathering data from financial institutions (Wada 2008). According to the BOJ, the introduction of XBRL for monthly balance sheet information has led to a significant reduction in the burden of data validation and other gains in efficiency. In July 2008, the TSE introduced the third generation TDnet server for XBRL production use, at which time provisions of financial data in the XBRL format commenced. Earnings reports and corporate governance reports were submitted in the XBRL format under the timely disclosure policy, which was applicable to about 4,000 listed companies at stock exchanges in Japan (Yoshida 2008).

The FSA has an EDINET system, which started its operations in June 2001. The EDINET is an electronic corporate disclosure system under the Financial Instruments and Exchange Act, and all listed companies and investment funds in Japan are required to file their disclosure documents using the system. These submitted corporate disclosure documents are prepared in HTML format and publicly available on the Internet through EDINET. Within this system, a series of procedures ranging from submission, receipt, and public viewing of annual securities reports (*yukashoken houkokusho* in Japanese) and other disclosure documents are carried out online. These procedures were implemented on paper prior to the introduction of the EDINET system. Thus, EDINET serves as a platform for information disclosure, enabling the prompt disclosure of critical information for investors and issuers, and allowing the general public to instantly access corporate information that has been submitted (Takeda 2008).

On March 17, 2008, the FSA launched a new EDINET system in preparation for the adoption of XBRL. All filers are mandated to submit the financial statements included in their annual securities reports, semiannual securities reports, quarterly securities reports and securities registration statements for fiscal years starting in or after April 2008 in the XBRL format. Quarterly securities reports for the first fiscal quarter ending in June 2008 comprised the first filing in the XBRL format. In other words, financial statements in the XBRL format can be retrieved from the EDINET as of the end of June, 2008.[18] These financial statements in the XBRL format are to be prepared using "EDINET Taxonomy" (JP-GAAP taxonomy). Since autumn 2009, the FSA has been conducting research and

[18] Precisely speaking, financial statements in the XBRL format became available at the EDINET in June 29, 2008. The number of the filers in June, 2008 was nine.

testing to expand the XBRL's scope of application and upgrade EDINET's functionality. EDINET is currently scheduled to be upgraded in fiscal 2013.

Appendix 2: Literature review on the reporting quality of XBRL

The reporting quality of XBRL-based financial reports is vital for its success. It is expected that human errors will be minimized as XBRL reduces the need for repetitive data entry (Morgan 2009), which will help to improve both data migration efficiency and accuracy. However, the literature provides evidence that the XBRL reporting still contains deficiencies and incompleteness (Zhu and Fu 2009; Debreceny et al. 2010; Bartley et al. 2011; Roohani and Zhen 2011).

Zhu and Fu (2009) develop metrics to empirically evaluate financial reports created using the XBRL data standards. The use of standard elements and company-specific elements is found to vary substantially across companies. An average company uses 128 elements from the XBRL standard, which defines about 2,000 elements, and introduces 64 elements of its own. Completeness and relevancy of a data standard affect the interoperability of data created. However, they show that the XBRL standard has low completeness and relevancy from an individual company's perspective. To the average company, the completeness of the XBRL standard is 66.67 percent, and the relevancy of the standard is 6.4 percent.

Debreceny et al. (2010) study one aspect of data quality errors in the computation of related monetary facts in the XBRL filings. Out of 400 filers, they discover one quarter have computational errors, half of which are due to inappropriate treatment in the instance documents of the underlying debit/credit assumptions in the taxonomy. An additional quarter of the errors are due to missing or extraneous values in a calculation relationship. Bartley et al. (2011) also find that all 22 companies made errors during the first year of voluntary XBRL filings by examining 22 companies' initial voluntary XBRL 10-K filings. To find determinants of the deficiency of XBRL mandatory filings, Roohani and Zheng (2011) investigate all the SEC filings from July 2009 to December 2010. They conclude that XBRL deficient filings tend to have a higher percentage of extensions and are filed by bigger and more complex firms.[19] In addition, firms that have considerable experience in XBRL filings are less likely to have major errors. On the contrary, they are more likely to have minor errors.

The reporting quality of XBRL is also related to the issue of whether XBRL taxonomies, which have a crucial role in digital financial reporting by providing a unique set of computer-readable tags to allow the interchange of interactive information, are consistent with the reporting practices (Bonson et al. 2009; Valentinetti and Rea 2011).

[19] Sakaue (2011) investigates the XBRL data of early adopters of International Financial Reporting Standards (IFRS) taxonomy in Japan and finds that company-specific extended items accounts for more than 60% of the whole in financial statements.

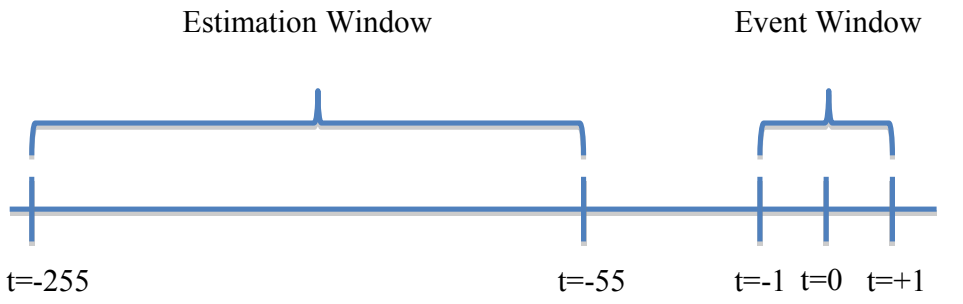
Bonson et al. (2009) argue that multiple XBRL taxonomies, based on different accounting principles, contradict the objectives of standardization, comparability, and reusability of the XBRL information. They evaluate the effectiveness of the IFRS-GP taxonomy that could establish a common ground for international firms and create a platform that would enhance the benefits of XBRL. Valentinetti and Rea (2011) also attempt to verify whether the IFRS taxonomy released by the IFRS Foundation adequately reflects the reporting practices of Italian listed companies. The results reveal a general discrepancy between the financial items disclosed by the firms and the taxonomy tags. Specifically, they find that the financial statements items are more disaggregated than the taxonomy tags and as such a loss of detailed information may occur if the taxonomy is applied.

Appendix 3: Variable definitions

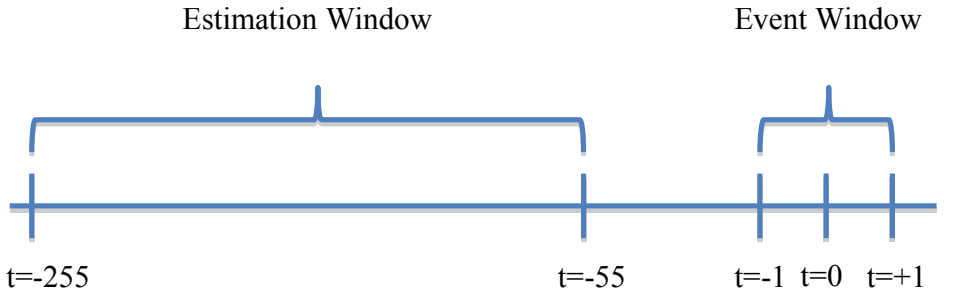
ERV	Arithmetic sum of the absolute values of ARs over the event window $$\sum_{t=-1}^{1} \lvert AR_t \rvert$$
ACAR	Cartesian product of ARs in the event window: $\lvert \prod_{t=-1}^{1} [1 + AR_t] - 1 \rvert$
ΔSTDDEVRET	Change in the standard deviation of daily stock returns before and after the firm's annual securities report filing dates $$\sqrt{\frac{1}{30}\sum_{t=0}^{30}(R_t - \bar{R}_t)^2} - \sqrt{\frac{1}{30}\sum_{t=-30}^{0}(R_t - \bar{R}_t)^2}$$
ASPREAD	Difference between the average daily spread during the event window and the average daily spread during the estimation window $$Average\ daily\ spread_{Event\ window} - Average\ daily\ spread_{Estimation\ window}$$
AVOL	Difference between the mean daily trading volume during the event window and the mean daily trading volume during the estimation window, divided by the standard deviation of the daily trading volume during the estimation window $$\frac{Average\ daily\ volume_{Event\ window} - Average\ daily\ volume_{Estimation\ window}}{STDDEV\ daily\ volume_{Estimation\ window}}$$
XBRL	Dummy variable that is equal to 1 in the post-XBRL period and 0 otherwise
SIZE	Natural log of market capitalization
MB	Market to book ratio
EPRATIO	Earnings to price ratio
LEV	Long-term debt divided by total assets
LOSS	Dummy variable that is equal to 1 if the fiscal year's net income is negative and 0 otherwise.
TECH	Dummy variable that is equal to 1 for firms that are classified under IT & Services and 0 otherwise
GOV	Percentage of shares held by foreign shareholders
RETVAR	Standard deviation of the firm's ARs during the estimation window
NEGCAR	Dummy variable that is 1 if cumulative ARs during the estimation window are negative and 0 otherwise
CAAR	Cumulative absolute AR around the filing date from t=-30 to t=+30

Figure 1: Timeline of the event study

(a) Pre-XBRL period (January 1, 2008 – June 30, 2008)



(b) Post-XBRL period (January 1, 2009 – June 30, 2009)



Note: t = 0 is the event date when the firm's annual securities report is filed in EDINET.

Table 1: Distribution of sample by TOPIX-17 series sector code

Code	Category	No.	%
1	Foods	49	4.31
2	Energy Resources	10	0.88
3	Construction & Materials	111	9.75
4	Raw Materials & Chemicals	123	10.81
5	Pharmaceutical	20	1.76
6	Automobiles & Transportation Equipment	53	4.66
7	Steel & Nonferrous Metals	50	4.39
8	Machinery	87	7.64
9	Electric Appliances & Precision Instruments	124	10.9
10	IT & Services, Others	157	13.8
11	Electric Power & Gas	11	0.97
12	Transportation & Logistics	47	4.13
13	Commercial & Wholesale Trade	91	8.00
14	Retail Trade	95	8.35
15	Banks	57	5.01
16	Financials excluding Banks	24	2.11
17	Real Estate	29	2.55
	Total	1,138	100.00

Table 2: Descriptive statistics

	Pre-XBRL (n=1,138)			Post-XBRL (n=1,138)			Post - Pre (Mean)
	Median	Mean	S.D.	Median	Mean	S.D.	t-value
ERV	0.036	0.043	0.033	0.037	0.044	0.031	0.630
ACAR	0.018	0.025	0.025	0.018	0.024	0.024	-0.333
ΔSTDEVRET	0.000	0.000	0.009	-0.002	-0.003	0.010	-6.264 ***
ASPREAD	-0.088	0.059	0.882	-0.410	-0.320	0.554	-12.267 ***
AVOL	-0.392	0.392	9.418	-0.292	0.115	2.920	-0.947
XBRL	0.000	0.000	0.000	1.000	1.000	0.000	-
SIZE	24.504	24.721	1.489	24.274	24.451	1.474	-4.353 ***
MB	1.038	1.306	1.107	0.881	1.088	0.952	-5.031 ***
EPRATIO	0.058	0.042	0.137	0.028	-0.051	0.304	-9.462 ***
LEV	0.130	0.160	0.136	0.140	0.176	0.146	2.628 ***
LOSS	0.000	0.093	0.291	0.000	0.335	0.472	14.705 ***
TECH	0.000	0.138	0.345	0.000	0.138	0.345	-
GOV	0.108	0.139	0.118	0.084	0.117	0.109	-4.625 ***
RETVAR	0.025	0.026	0.008	0.037	0.037	0.010	30.118 ***
NEGCAR	0.000	0.435	0.496	0.000	0.437	0.496	0.085
CAAR	0.100	0.137	0.129	0.122	0.160	0.157	3.751 ***

Note: *** indicates significance at the 1 % level.

Table 3: Pearson correlation matrix for explanatory variables

	XBRL	SIZE	MB	EPRATIO	LEV	LOSS	TECH	GOV	RETVAR	NEGCAR
SIZE	-0.091									
MB	-0.105	0.237								
EPRATIO	-0.195	0.155	0.062							
LEV	0.055	0.148	0.058	-0.085						
LOSS	0.295	-0.174	-0.110	-0.548	0.103					
TECH	0.000	-0.077	0.183	0.034	-0.063	-0.044				
GOV	-0.097	0.622	0.144	0.071	-0.015	-0.120	-0.012			
RETVAR	0.525	-0.023	0.102	-0.295	0.126	0.299	-0.069	0.074		
NEGCAR	0.002	0.073	0.050	-0.022	0.085	0.008	-0.056	0.036	-0.021	
CAAR	0.079	-0.174	0.067	-0.169	-0.008	0.142	0.012	-0.052	0.234	0.104

Table 4: Correlation with dependent variables

	ERV	ACAR	ΔSTDDEVRET	ASPREAD	AVOL	VIF
XBRL	0.013	-0.007	-0.128	-0.249	-0.020	1.130
SIZE	-0.095	-0.055	0.136	-0.060	-0.062	1.296
MB	0.133	0.062	-0.027	0.006	-0.004	1.025
EPRATIO	-0.121	-0.097	0.088	0.011	-0.030	1.121
LEV	0.047	0.054	-0.037	-0.034	0.038	1.006
LOSS	0.142	0.075	-0.107	-0.023	0.071	1.144
TECH	0.042	0.008	-0.044	-0.034	0.013	1.005
GOV	-0.010	0.001	0.109	-0.037	-0.053	1.220
RETVAR	0.251	0.163	-0.082	-0.179	-0.004	1.200
NEGCAR	-0.096	-0.090	-0.024	-0.053	-0.032	1.001
CAAR	0.281	0.256	-0.143	0.093	0.140	1.011

Table 5: Regression results for the information environment around filing dates

	Model 1 (ERV)		Model 2 (ACAR)		Model 3 (ΔSTDDEVRET)		Model 4 (ASPREAD)		Model 5 (AVOL)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
XBRL	-0.010	-6.435 ***	-0.006	-5.123 ***	-0.002	-4.545 ***	-0.334	-8.94 ***	-0.533	-1.196
SIZE	-0.002	-3.259 ***	-0.001	-1.259	0.001	3.444 ***	-0.027	-1.937 *	-0.093	-1.643
MB	0.003	2.150 ***	0.001	0.642	-0.001	-1.807 *	0.012	0.54	-0.017	-0.244
EPRATIO	0.001	0.360	-0.003	-1.050	0.001	0.549	-0.043	-0.644	0.746	1.267
LEV	0.008	1.775 *	0.009	2.179 **	-0.003	-1.792 *	-0.035	-0.336	2.212	1.458
LOSS	0.007	2.893 ***	0.001	0.455	-0.001	-1.482	0.076	1.513	1.284	1.616
TECH	0.003	1.524	0.001	0.324	-0.001	-1.311	-0.110	-2.365 **	0.232	0.537
GOV	0.005	0.703	0.003	0.468	0.003	1.152	-0.048	-0.281	-1.555	-2.037 **
RETVAR	0.779	10.673 ***	0.377	6.582 ***	0.030	1.162	-7.512	-4.178 ***	-20.416	-2.610 ***
NEGCAR	-0.008	-6.504 ***	-0.005	-5.621 ***	-0.001	-1.568	-0.059	-1.957 *	-0.367	-1.368
CAAR	0.044	5.312 ***	0.036	5.788 ***	-0.007	-2.358 **	0.616	4.604 ***	6.738	2.761 ***
F-test	40.984 ***		23.165 ***		12.126 ***		20.665 ***		6.412 ***	
Adjusted R^2	0.162		0.097		0.051		0.087		0.026	
No. of Obs.	2,276		2,276		2,276		2,276		2,276	

Notes:

1: The regression is conducted by using White heteroskedasticity-consistent standard errors & covariance
2: *, **, and *** indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Regression results for the information environment around filing dates (without firms in financial industry)

	Model 1 (ERV)		Model 2 (ACAR)		Model 3 (ΔSTDDEVRET)		Model 4 (ASPREAD)		Model 5 (AVOL)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
XBRL	-0.011	-6.560 ***	-0.006	-5.005 ***	-0.002	-4.034 ***	-0.333	-8.610 ***	-0.533	-1.146
SIZE	-0.001	-1.801 *	0.000	-0.229	0.001	3.757 ***	-0.014	-0.947	-0.091	-1.300
MB	0.003	1.940 *	0.001	0.619	-0.001	-1.760 *	0.005	0.237	-0.016	-0.220
EPRATIO	0.002	0.446	-0.003	-1.126	0.001	0.677	-0.039	-0.559	0.857	1.343
LEV	0.004	0.848	0.006	1.313	-0.004	-2.227 **	-0.164	-1.426	2.299	1.336
LOSS	0.008	3.152 ***	0.001	0.787	-0.001	-1.143 ***	0.106	1.967 **	1.395	1.649 *
TECH	0.003	1.367	0.000	0.191	-0.001	-1.439	-0.121	-2.572 **	0.227	0.525
GOV	-0.002	-0.212	-0.001	-0.172	0.001	0.366	-0.145	-0.775	-1.655	-2.221 **
RETVAR	0.796	10.565 ***	0.374	6.345 ***	0.034	1.279	-7.804	-4.220 ***	-21.628	-2.576 **
NEGCAR	-0.008	-6.289 ***	-0.005	-5.472 ***	-0.001	-1.603	-0.056	-1.777 *	-0.361	-1.279
CAAR	0.045	5.255 ***	0.037	5.746 ***	-0.008	-2.315 **	0.660	4.805 ***	6.941	2.749 ***
F-test	37.984	***	21.676	***	10.787	***	0.089	***	6.096	***
Adjusted R^2	0.161		0.097		0.048		19.812		0.026	
No. of Obs.	2,114		2,114		2,114		2,114		2,114	

Notes

1: The regression is conducted by using White heteroskedasticity-consistent standard errors & covariance.

2: *, **, and *** indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Regression results for the information environment around filing dates based on alternative pre- and post-XBRL periods

	Model 1 (ERV)		Model 2 (ACAR)		Model 3 (ΔSTDDEVRET)		Model 4 (ASPREAD)		Model 5 (AVOL)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
XBRL	0.003	1.430	0.004	1.943 *	-0.002	-4.054 ***	0.291	6.100 ***	-0.091	-0.530
SIZE	-0.001	-0.937	0.000	0.038	0.001	5.744 ***	-0.028	-1.527	0.033	0.935
MB	0.003	2.123 **	0.002	1.552	-0.001	-2.524 **	0.005	0.182	0.009	0.218
EPRATIO	0.000	-1.023	0.000	0.360	0.000	-1.650 *	0.000	0.143	0.000	-1.286
LEV	0.006	1.027	0.008	1.540	-0.003	-1.506	0.134	0.913	0.481	1.447
LOSS	0.006	1.484	0.003	1.026	-0.002	-2.354 **	0.161	1.615	0.895	0.985
TECH	-0.002	-0.720	-0.001	-0.556	-0.001	-1.456	-0.095	-1.615	-0.359	-2.644 ***
GOV	-0.009	-1.143	0.000	-0.026	0.002	0.841	0.044	0.193	-1.372	-2.246 **
RETVAR	0.885	6.365 ***	0.389	3.372 ***	0.090	2.031 **	-10.653	-3.402 ***	-29.159	-1.798 *
NEGCAR	-0.004	-3.118 ***	-0.004	-3.541 ***	-0.001	-1.120	-0.035	-0.898	-0.207	-1.541
CAAR	0.071	5.405 ***	0.055	4.336 ***	-0.001	-0.141	0.983	4.542 ***	6.158	2.138 **
F-test	40.549	***	26.307	***	8.978	***	9.148	***	8.682	***
Adjusted R^2	0.206		0.142		0.050		0.051		0.048	
No. of Obs.	1,678		1,678		1,678		1,678		1,678	

Notes

1: The regression is conducted by using White heteroskedasticity-consistent standard errors & covariance.
2: *, **, and *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively.