The Effect of XBRL Disclosures on Information Environment in the Market: Early Evidence

Joung W. Kim
H. Wayne Huizenga School of Business and Entrepreneurship
Nova Southeastern University
Davie, FL 33314
Phone: 954-262-5110 Fax: 954-262-3974
Email: joung@nova.edu

Jee-Hae Lim*
School of Accounting and Finance
University of Waterloo
Waterloo, ON N2L 3G1 (Canada)
Phone : 519-888-4567 (x35702) Fax : 519-888-7562
Email : jh2lim@uwaterloo.ca

Won Gyun No
College of Business
Iowa State University
Ames, Iowa 50011-1350
Phone : 515-294-4889 Fax : 515-294-3525
Email : wgno@iastate.edu

March 25, 2011

* Corresponding author

Acknowledgements
We would like to thank Efrim Boritz, Roger Debreceny, Ken Klassen, Rob Pinsker, Rajendra Srivastava, Christine Wiedman, and participants, discussants and anonymous reviewers at the 2011 AIS Mid-Year American Accounting Association meeting, the 21st XBRL International Conference, as well as the research workshop at Yonsei University, and Seoul National University. We acknowledge the financial support provided by the Centre for Information Systems Assurance (sponsored by the Canadian Institute of Chartered Accountants), the Information Systems Audit and Control Association, Caseware IDEA Inc., and the University of Waterloo.

The Effect of XBRL Disclosures on Information Environment in the Market: Early Evidence

ABSTRACT:

This study examines the effect of XBRL adoption across the financial information environment (event returns volatility, information efficiency, standard deviation of daily stock returns, and analysts forecast errors), particularly after XBRL reporting was mandated, June 15, 2009.Our findings indicate that XBRL disclosures have the potential to decrease information risk and information asymmetry in the market by increasing transparency to capital markets. Results of this study further indicate that such transparency effectively levels the playing field for uninformed investors by enabling them to assess the amount, timing, and uncertainty of future cash flows. In addition, this research shows that XBRL mitigates information risk in the market, especially when there is increased complexity in the information environment. Our results could potentially assist the SEC in their effort to expeditiously assess the benefits of XBRL, especially given a range of concerns such as XBRL implementation costs, incomparability of various taxonomy extensions, and the stability of XBRL standards in relation government requirements.

Keywords: XBRL (eXtensible Business Reporting Language); information risk, information efficiency; information complexity; capital markets.

I. INTRODUCTION

On December 17, 2008, new rules by the U.S. Securities and Exchange Commission (SEC, hereafter) required firms to disclose financial statements to the SEC and on their corporate web sites in an interactive data format, using the eXtensible Business Reporting Language (XBRL, hereafter) (SEC 2008). This interactive data format provides a standard method to prepare, publish, and exchange financial information. It improves data processing by reducing or eliminating costly manual processes and allowing more accurate data handling and improved analysis. Proponents of XBRL claim that interactive data not only makes financial information easier for analysts, investors, regulators, and any related parties to access and analyze, but also assists in automating regulatory filings and business information processing (Cox 2006; Eccles et al. 2001; Hoffman and Strand 2001; Hodge et al. 2004; SEC 2009). Enhanced efficiency in XBRL disclosure could translate into friction-less information flow and dissemination in the capital market for users who acquire, integrate and combine finance-related information to make better informed investment decisions (Gray and Miller 2009; Hodge et al. 2004; Software AG 2002; XBRL US 2009). In fact, firms might experience a narrowing of the information gap (or information asymmetry) due to improved, transparent, real-time financial reporting and disclosure of data (Apostolou and Nanopoulos 2009; Cohen et al. 2005; Premuroso and Bhattacharya 2008; Roohani et al. 2009; Yoon et al. 2010).

While XBRL has the potential to increase the speed, accuracy and usability of financial disclosure (Garbellotto 2009; XBRL International, 2007; Willis et al. 2003), and to eventually accelerate the flow of information in the market, several concerns may still limit the broad use of interactive data in the marketplace. First, the costs of XBRL-based financial reporting, including infrastructure, software and training expenses may often exceed the benefits, especially during the first few years after adoption of the program (Aguilar 2008; Debreceny et al. 2005; Doolin and Troshani 2007; Pinsker 2008). Seond, the change of the disclosure format may cause a temporal inefficiency as XBRL is a standardized machine-readable format, making it difficult for most people to review or use XBRL-tagged data directly. For instance, changes in XBRL specification, taxonomies, or government requirements (e.g., the EDGAR filer manual) require firms to learn about new changes and software vendors to update their products, entailing labour and monetary cost. This can result in distrust in the program, potentially raising the relational risk and cost of capital for the firm (Doolin and Troshani 2007; Nicolaou et al. 2003). Third, the sufficiency and completeness of the XBRL taxonomies continues to be a concern for early adopters and users of interactive data, even though XBRL allows firms to create their own taxonomy extensions. Such extensions may decrease the comparability of instance documents across reporting periods and between firms (Boritz and No, 2008; Debreceny and Farewell, 2010).

Given that some users are not versed in XBRL, even though it is a conceptually improved delivery format, information risk in capital markets could increase. Specifically, informed investors such as financial analysts are more likely to adjust to the change than uninformed investors such as small individual investors. When only informed investors are able to reap the accessibility benefits of XBRL implementation, the information gap between informed investors and uninformed investors increases.

The objective of this study is to examine the effect of XBRL disclosure across various aspects of the financial information environment, especially after June 15, 2009. We employ four proxies to measure information environment changes in the market: event returns volatility, information efficiency, the change of standard deviation of daily stock returns, as well as the change of standard deviation of analysts earnings forecasts. Event return volatility is the sum of the absolute values of daily abnormal returns around SEC filing dates. Information efficiency is estimated by the absolute deviation between the price on a given day and the expected stock price estimated by the market model. The higher deviation suggests that the market has less public information (wider information gap) and higher information asymmetry between informed and uninformed investors (Heflin et al 2003). We found a significant decrease in all of our information risk measures. Our results suggest that adopting XBRL for financial statements lowers the informational advantage of informed investors, thus levelling the playing field.

Secondly, we examine the impact of XBRL on information complexity of 10-K by incorporating the absolute amount of unexpected earnings surprises for the corresponding quarter. *Earnings surprise*, which indicates the gap between analysts' expectation and actual performance, show the complexity of the information environment (i.e., understanding financial statements). In times of greater earnings surprise, informed investors are more likely to have an advantage in forecasting future cash flows relative to uninformed investors; and this information advantage triggers information asymmetry in the market. Thus, in these cases, XBRL would be more effective in reducing this information advantage because it aids uninformed investors by improving the accessibility or readability of 10-K. Our results show that XBRL disclosure mitigates the decrease (increase) of earnings surprise in information efficiency (return volatility). We found only marginal information risk when event return volatility and analyst forecast dispersion is used with XBRL disclosure.

Our study contributes to AIS research by systematically documenting evidence of how XBRL mandated disclosures decrease information risk and information asymmetry in both general and complex information environments. First, our study demonstrates that firms making

XBRL submissions to the SEC decrease information risk. Second, our findings suggest that XBRL disclosure mitigates the increase in information efficiency due to information complexity. This study could potentially assist the SEC in their efforts to expeditiously assess the benefits of XBRL, especially given a range of concerns such as XBRL implementation costs, incomparability of various taxonomy extensions, and the stability of XBRL standards in relation government requirements.

The remainder of this paper is structured as follows. Section II provides study background and hypotheses development. Section III outlines the methods employed in the study. Section IV indicates the results of the statistical analysis of the XBRL adoption on the financial risks of firms. Section V includes a summary with conclusions and recommendations for future research.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

On December 17, 2008, the U.S. Securities and Exchange Commission (SEC) approved a new rule that mandates the use of an interactive data format in financial reporting using XBRL (SEC, 2009).[1] The SEC mandate requires firms to tag their primary financial statements, company identification information, schedules and footnote disclosures using the most recent official XBRL taxonomies.[2] Firms that do not provide the required interactive files, or that fail to

---

[1] The SEC rule requires firms to provide their interactive data as exhibits to the SEC and to be posted on corporate web sites, at the time the registration statement or when the report is filed or required to be filed, whichever is earlier. The rule applies to all public firms and will be phased in over a three-year period (SEC, 2009). In year 1, domestic and foreign large accelerated filers using U.S. Generally Accepted Accounting Principles (GAAP), and that have a worldwide public float of greater than $5 billion as of the end of the second fiscal quarter of their most recently completed fiscal year, are subject to interactive data reporting for their first quarterly report on Form 10-Q or annual report on Form 20-F or Form 40-F for fiscal periods ending on or after June 15, 2009. In year 2, all other domestic and foreign large accelerated filers using U.S. GAAP are subject to initial interactive data submissions beginning with a fiscal period ending on or after June 15, 2010. In year 3, all remaining filers, as well as foreign private issuers using International Financial Reporting Standards (IFRS), are required to use interactive data in their financial reporting for fiscal periods ending on or after June 15, 2011.

[2] For footnote disclosures and schedules, firms are allowed to use block tagging (e.g., each footnote is tagged as a single block of text) for first filing but are required to use detailed tagging (e.g., each table and amount within each

post the required data on their web site, will be deemed 'not current' with their Exchange Act reports. Consequently, they will not be eligible to use short form registration statements on Form S-3, Form F-3, or Form S-8, or to incorporate information by reference on Forms S-4 of F-4. In addition, these firms will not be able to utilize the resale exemption safe harbor provided by Rule 144 (SEC 2009, pp. 106-107). Furthermore, interactive data submissions are subject to modified liability treatment under the federal securities laws during the first two years of required XBRL reporting. During this period, interactive data submissions will be deemed furnished, but not filed, and thus will not be required to obtain auditor assurance on their interactive data submissions (SEC 2009, pp. 84-85).

XBRL was developed to further enhance information exchange by providing a standardized method to prepare, publish and exchange business information (Hoffman and Strand 2001; XBRL International 2007; XBRL US 2009). In XBRL, all information is tagged to identify each individual item of data using machine-readable XBRL elements defined in XBRL taxonomies. An XBRL taxonomy is a dictionary of XBRL elements that represent financial terms used in preparing financial statements or other business reports. The taxonomy defines individual reporting concepts (e.g., total assets) as well as the relationships between concepts (e.g., the human-readable label of each concept and how values of concepts should sum up from one to another). Thus, financial statements or other business reports of a firm are tagged with XBRL elements, and the XBRL-tagged document itself is called an XBRL instance document. Figure 1 illustrates how financial facts are tagged using XBRL elements, which can simplify the delivery format of 10-K and increase readability or accessibility for users.

[Insert Figure 1]

---

footnote is tagged separately) after the first year. In addition, the new rule provides a 30-day grace period for both the initial interactive data submission and for the first filing of footnotes and schedules tagged in detail.

An XBRL instance document is created by mapping financial facts (e.g., cash and cash equivalents) in financial statements to corresponding XBRL elements (e.g., CashAndCashEquivalentsAtCarryingValue) in XBRL taxonomies. Specifically, each financial fact (the arrow labelled 'Tagged value' in Figure 1) is identified using the corresponding element (the dotted arrow labelled 'XBRL element' in Figure 1) along with additional information; this includes unit information (the dotted arrow labelled 'Unit of measure' in Figure 1) that specifies the units in which a financial fact has been measured (e.g., USD and CAD); and, context information (the arrow labelled 'Context' in Figure 1) providing additional detail (the dotted arrow labelled 'Reporting entity and period' in Figure 1) such as reporting entity, reporting period and the accuracy of the facts. For example, the code block in figure 1 specifies that $510,058,000 is related to 'Cash and Cash Equivalent' account on December 31, 2008 whereas $47,038,000 indicates 'Cash and Cash Equivalent' account on June 30, 2009. In addition, the unit of measurement is the US dollar, and the decimal of 3 indicates that the value is known to be correct to 3 decimal places.

Figure 2 also shows an example that illustrates how investors can use XBRL-tagged information for ratio analysis. Currently, investors can obtain financial information of most firms over the Internet and use it for their analysis. In particular, the EDGAR ('The SEC EDGAR System' in Figure 2) provides both official financial statements and XBRL-tagged information. For instance, an investor seeking to perform ratio analysis may obtain official SEC filings ('HTML or PDF version of Financial Information' in Figure 2) from the EDGAR system. However, the HTML or PDF version of financial information often cannot be easily incorporated into spreadsheets and other analysis software, requiring tedious, costly and error-prone cutting and pasting or transcription. Alternatively, the investor can obtain XBRL-tagged information

('XBRL Instance Document' in Figure 2) and use it for his or her analysis. Since XBRL is a machine-readable format, the investor may need to use a rendering tool ('Interactive Data Viewer' in Figure 2) that converts XBRL-tagged information into a presentation that can be visually inspected by him or her. Furthermore, the investor can import the XBRL-tagged information into analysis software ('Excel' in Figure 2) and easily perform the ratio analysis.[3]

[Insert Figure 2]

While using XBRL has benefits, it also has some limitations. At present, there is no requirement to provide independent assurance on the XBRL version of the official financial statements. Under the SEC's mandate, the filers of interactive data are subject to limited liability during the company's first two years of required interactive data reporting. During this period, interactive data submissions will be deemed to be furnished, not filed, for the liability provisions of Security Acts and Security Exchange Act, and not subject to specified antifraud provisions if inaccurate XBRL-related documents are provided in good faith and are promptly corrected after the filer becomes aware of the inaccuracy (SEC 2009). However, prior studies have shown evidence of inadequacies in XBRL documents (Boritz and No, 2008; Debreceny et al., 2010; Weirich and Harrast, 2010; XBRL US, 2010).[4] In addition, information on the Internet, including XBRL instance documents, can be created and revised easily but are also vulnerable to interception and tampering. XBRL does not currently take into account the quality of the information or whether XBRL-tagged data is accurate and reliable. This potentially leads to concerns about the reliability and quality of XBRL-tagged information, which, in turn, hinders the success of XBRL (Boritz and No 2009; Plumlee and Plumlee 2008).

---

[3] See Tribunella and Tribunella (2010) for a more detailed and comprehensive example.

[4] For instance, Boritz and No (2008) examined XBRL filings in the SEC's XBRL Voluntary Filing Program on EDGAR (hereafter, VFP) and found that most XBRL filings contained exceptions, inconsistencies, and errors. Debreceny, Farewell, Piechocki, Felden, and Gräning (2010) studied the first filings under the SEC's Mandatory XBRL Filing program and also found a significant number of errors.

Another drawback is the relative incomparability of XBRL instance documents due to limited constraints on the manner in which XBRL taxonomies are produced and managed. Firms, particularly in the U.S., are allowed to create their own extension taxonomies if they cannot find appropriate XBRL elements in the standard taxonomies. According to SEC (2010), some firms have used a less appropriate standard element even though a more appropriate standard element exists. Also, a number of firms have used a standard element when they should create an extension element, while others have created an extension element when an appropriate standard element exists. Therefore, inappropriate use of XBRL elements may affect the comparability of XBRL instance documents when looking across firms (Boritz and No, 2008; Debreceny and Farewell, 2010).

Because of the benefits and limitations described above, the implementation of XBRL can affect information quality or information risk in capital markets. Given the uncertainties that often permeate the benefit and cost streams associated with XBRL adoptions (Aguilar 2008; Debreceny et al. 2005; Doolin and Troshani 2007; Pinsker 2008), in practice it has often been questioned if XBRL adoption will pay off in terms of an organization's improved information environment. The objective of this research is to provide some answers to these questions. We use the interactive data submissions under the new SEC rules to examine whether financial reporting using XBRL is relevant to investors in assessing the financial information environment.

Hypothesis Developments

The ultimate financial benefits reaped by publicly traded firms that use XBRL for disclosure have long been recognized as important advantages of the XBRL system (Hodge et al. 2004; Premuroso and Bhattacharya 2008; Yoon et al. 2010). Essentially, XBRL reduces the time and cost of producing and consuming information, improves accessibility of information, and increases financial reporting transparency (Hoffman and Strand 2001; Pinsker and Li 2008). The improved transparency and disclosure of data in XBRL format reduces a firm's capital costs (XBRL International 2002). In fact, XBRL can reduce information asymmetry resulting from incompatible international reporting format (Bergeron 2003; XBRL International 2007); and it provides a standardized method to prepare and exchange business information, and especially financial data. Each piece of business and financial data is tagged using a unique XBRL element in an agreed upon taxonomy, allowing information users (e.g., analysts, investors, regulators, and any related parties) to easily acquire and integrate information to evaluate business and financial information (Hodge et al. 2004; Hoffman and Strand 2001; SEC 2010b; XBRL US 2009). Faster navigation of financial data across a market or industry can uncover anomalies and prepare updated reports (Cohen et al. 2005; Gray and Miller 2009; Premuroso and Bhattacharya 2008).

The introduction of another regulatory change, Reg FD (Regulation Fair Disclosure), was shown to affect financial information flow in the market. In October 2000, Reg. FD was designed to enhance the information flow to financial markets by eliminating firms' selective disclosure practice. However, the SEC continues to address the concern that selective disclosure creates an informational advantage from which the selective investors can profit at the expense of others. Reg. FD was originally designed to improve information accessibility and transparency, which is similar to the outcomes of XBRL implementation. Previous research on the effect of Reg. FD shows that increases in information accessibility and disclosure transparency improve informational efficiency of stock prices in the market. Heflin et al. (2003) document an improvement in informational efficiency after implementation of Reg. FD, as measured by information gap (absolute deviation between the prices around earnings announcements and the benchmark prices estimated by the market model). Bailey et al. (2003) reports a decline in return volatility and an increase in informational efficiency after Reg. FD. Improved information accessibility and financial reporting transparency to the public helped reduce informational advantages of selective (informed) investors, and lowered information risk and enhance informational efficiency.

This, in turn allows us to examine whether the effects of XBRL are expected to mitigate information asymmetry; in other words, higher information efficiency and lower information risks are expected in the market after the XBRL disclosures. This leads to the following hypotheses:

> **H1a:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) decrease levels of information risk in the post- XBRL period.
>
> **H1b:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) increase levels of information efficiency in the post- XBRL period.
>
> **H1c:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) decrease levels of return volatility in the post- XBRL period.

XBRL disclosures are expected to reduce uncertainty and enable analysts to access similar information, and in turn reduce the forecast dispersion among analysts. As well, the standardized taxonomy of XBRL instance documents can increase data integrity and uniformity. For instance, when the U.S. Federal Deposit Insurance Corporation (FDIC) implemented an XBRL process in the quarterly collection of financial data (i.e., Call Reports) from approximately 8,200 U.S. banks at the end of 2005, the improved process allowed the FDIC to gather and analyze cleaner, more accurate data and publish more timely information for the banking industry (FFIEC 2006). Furthermore, XBRL is platform-independent which offers data exchange among any hardware platforms, software operating systems and programming languages (XBRL International 2007). This enhances the inter-operability of the data contained in XBRL instance documents, allowing investors, external analysts, and other users to automatically obtain, validate, and analyze data that is electronically received through XBRL. Therefore, XBRL improves analytical capabilities to review business and financial data (Gray and Miller 2009; XBRL US 2009).

Given that early filers using XBRL already show strength in financial statement transparency and related disclosure, such users signal the increased transparency of their financial information (Pinsker and Li 2008). In other words, XBRL theoretically should level the disclosure playing field, allowing any type of investor to evaluate financial statement information across different types of firms. Hodge et al. (2004) argue that novice investors are more likely to benefit from using an XBRL-enhanced search engine than professional financial analysts. If there are differing perceptions of information among market participants (e.g., informed, less informed, or uninformed investors), then stock trades would become less frequent, and stock prices would inadequately reflect the rich body of information. To examine the effect of informed investors' behaviour as defined analyst forecast dispersion, we propose the following hypothesis:

> **H1d:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) decrease standard deviation of analysts' earnings forecasts in the post-XBRL period.

The extent of information complexity is related to investor under/over reaction when a firm makes an information announcement (Plumlee, 2003; You and Zhang, 2009; Lehavy et al., 2010). For example, You and Zhang (2009) suggest that investors underreact on 10-K filings because its information is difficult to understand. They explain that deciphering footnotes on deferred tax, pensions, and derivative transactions requires a significant amount of financial expertise. Kim and Verrechia (1994) document the effect of accuracy and timeliness of information before a public announcement on investors' market reaction to the announcement. In general, firms announce their earnings after the fiscal year end, but before the SEC filing date (e.g., 10-K filing date). Plumlee (2003) shows that information complexity reduces even expert analysts' use of information. In this study, we investigate whether XBRL improves investors' use of information in the market. In the market, most investors have high expectations for their earnings on investments. When high yields do not occur, this can result in an *earnings surprise*, which is the gap between the announced earnings figure and the investors' expectation, resulting in investor uncertainty about future cash flows.

When there is a higher uncertainty (earnings surprise) before the SEC filings among investors, they are more likely depend on the SEC filings to reduce the uncertainty, and XBRL would prove helpful in reducing information risk among investors. A key feature of information contained in the 10-K or 10-Q is the high volume and degree of complexity of that information. If XBRL can level the playing field for all investors' information processing of 10-K or 10-Q filings, including uninformed investors with access to similar information, then it could efficiently reduce information risk, even in a complex information environment. As noted earlier, the XBRL reduces information risks by allowing easy preparation, exchange and analysis that can increase the usability and comparability of financial information and enhance transparency in corporate financial reporting (Hodge et al. 2004; Hoffman and Strand 2001; SEC 2010b; XBRL US 2009). Therefore, with XBRL's transparency and speed of information diffusion, investors have greater information acquisition and integration that simplifies the complexity of the information. This leads to the following hypothesis:

> **H2a:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) mitigate the increasing effect of earnings surprise on event return volatility in the post-XBRL period.
>
> **H2b:** Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) mitigate the decreasing effect of earnings surprise on information efficiency in the post-XBRL period.

H2c: Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) mitigate the increasing effect of earnings surprise on return volatility in the post- XBRL period.

When a company's earnings are different from the average of analysts' earnings forecasts, information complexity increases in the market (You and Zhang 2009). In fact, earnings surprise is positively associated with information complexity that leads to increased information risk. When a firm's earnings are different from investors' expectations, informed investors can quickly adjust their expectation for future cash flows. To examine the effect of informed investors' behaviour on information complexity, we propose the following hypothesis:

H2d: Firms that adopted XBRL (i.e., furnished interactive data to the SEC's EDGAR) mitigate the increasing effect of earnings surprise on analyst forecast dispersion in the post- XBRL period.

III. METHODOLOGY

Sample

We gathered interactive data submitted using the EDGAR RSS (Really Simple Syndication) feeds monthly archives (http://www.sec.gov/Archives/edgar/monthly/) submitted to the SEC from June 15, 2009 to December 31, 2009.[5] To enhance the generalizability of all interactive data submissions, we conducted the manual validation,[6] and then used EDGAR URL in Figure 2 to capture verified information about each interactive data submission (e.g., EDGAR URL, company name, form type, filing date, and additional company information such as fiscal year end, SIC, and CIK).[7] To further validate the information of the program captured, we also

[5] CRSP data is available only until December 31, 2009.

[6] The result of the manual examination by one author and two research assistants for 5,545 interactive data submissions showed that one interactive data submission (i.e., Abbott Laboratories submitted on May 5, 2010) was incorrectly appeared in both 2010-05 and 2010-06 monthly RSS feeds.

[7] However, we found that the period of report posted on the EDGAR system was incorrect for a considerable number of interactive data submissions. Thus, we manually checked the period of report posted on the EDGAR system and corrected 636 incorrect reporting dates. In addition, we further validated by executing the program to capture the prior year information (i.e., date and period of report) of each interactive data submission. After this manual validation, we identified 391 incorrect reporting dates.

compare the information obtained from the SEC monthly RSS feeds with XBRL Cloud. This yielded 933 interactive data submissions.

We removed 17 submissions which were not included in the corresponding 10-K or 10-Q (e.g., 6-K, 20-F, and 40-F). We then checked 916 submissions for the large accelerated U.S. GAAP filers[8] with a worldwide public common equity float above $5 billion obtained from the latest annual audited financial information in XBRL interactive format as of June 15, 2009 from the SEC Interactive Financial Report viewer website. The filer's public float is measured on the last business day of the filer's most recently completed second fiscal quarter.[9] Of these firms, we eliminated 160 submissions, which were not the large accelerated U.S. GAAP filers and not covered by *Compustat, CRSP*, or *I/B/E/S*. The resulting sample size is 756 submissions from 391 publicly traded firms that adopted XBRL in Panel A of Table 1. For each of the 756 submissions, we matched the quarterly reporting period to the firm's corresponding quarter two- year prior to the date of XBRL adoption; this effectively controlled potential compounding effects of firm characteristics. Therefore, we compared the SEC filing effects between non-XBRL and XBRL adoption quarters (e.g., 756 Pre-XBRL vs. 756 Post-XBRL). Panel B of Table 1 provides a summary of the sample distribution based upon the quarter when XBRL adoption occurred and upon industry distribution by two-digit SIC code. The 756 XBRL firm-quarters cover 10 industry groups.

[Insert Table 1]

Information Risk Measures

[8] The large accelerated filers are subject to the new rules beginning with their first quarterly report on Form 10-Q, or annual report on Form 20-F, or Form 40-F that contains financial statements for fiscal periods ending on or after June 15, 2009.

[9] While we select interactive data in the first phase-in group, *i.e.*, for the quarterly report on Form 10-Q for the fiscal period ending on or after June 15, 2009, please note that the measurement date is the last business day of the filer's most recently completed second quarter. For instance, the measurement date of a firm is May 31, 2008 if its fiscal year-end is November 30 whereas the measurement date is June 30, 2008 if its fiscal year-end is December 31.

We use the following four measures of information risk to examine the impact of XBRL disclosures on information risk: event returns volatility, information efficiency, standard deviation of daily stock returns, and analysts forecast errors.

Following recommendations of prior studies (Bailey et al. 2003; Heflin et al. 2003; Francis et al. 2006), we measure event returns volatility around the firm's 10-K (or 10-Q) filing date by estimating the sum of the absolute values of daily abnormal return (ERV): Event Returns Volatility (ERV) = $\sum_{t=-1}^{+1}|AR_t|$ where AR_t^2 = firm's abnormal return on day t, and abnormal returns are calculated using the market model over the one year period ending the day before the start of the pre-XBRL quarter. Our estimation period of days is (-255, -55). The lower the event returns volatility, then the lower chance of information risk in the market.

Our measure of information efficiency (IE) determines the gap between the full information stock price and a pre-event price. We follow the prior studies' (Heflin et al. 2003; Francis et al. 2006) calculation of this measurement, which is the absolute deviation between actual return and the expected return by the market model over *h* days prior to the XBRL adoption: Information Efficiency (IE) = $\left|\prod_{t=-p}^{+2}[1+AR_t]-1\right|$, where *h* = 1 (or = 2) [e.g., IE (*h*= -1) or IE (*h*= -2)]. The smaller deviation implies a superior information environment. The abnormal returns are estimated using the market model over days (-255, -55). The above three measures investigate information environment around the SEC filing events, whereas for the next two measures we examine the information environment 30 days after the SEC filing event because market participants may delay their reaction to the event.

We use the change of standard deviation of daily stock return (VR) between before and after the filing dates that indicates the infrequency of information reaching the market and the degree of information asymmetry among market participants (Kothari et al. 2009). In fact, more informative disclosures can reduce market uncertainty for a firm's cash flows, and decrease return volatility. We measure the standard deviation of returns using daily return data for 30 days before and after the filing date. Then the change is estimated by the standard deviation of returns for 30 days after the filing dates minus the standard deviation of returns for 30 days before the filing dates. The positive change indicates an increase after the filing dates. Finally, we compare the changes of the pre- vs.post- XBRL years.

Our last measure, the change of standard deviation of analysts' earnings forecasts (AFE) indicates the effect of XBRL filings on information asymmetry among analysts (Heflin et al. 2003; Francis et al. 2006). We collect the standard deviation of analyst forecasts issued in a month before and after the filing date. We divided the standard deviation by stock price. The change is calculated by the standard deviation deflated by stock price after the filing date minus the standard deviation deflated by stock price before the filing date. The positive change indicates an increase in information asymmetry among analyst. We compare the changes of the pre- vs. post- XBRL years. More informative disclosures are expected to reduce uncertainty and enable all analysts to access common information, which would in turn reduce information asymmetry among them.

Control Variables

To evaluate the effect of pre- vs. post- XBRL on information risk, we control for the known factors that might be associated with the risk: firm size (SIZE), market-to-book ratio (MB), leverage (LEV), loss indicator (LOSS), return volatility for the estimation period (RETVAR), absolute value of cumulative abnormal return for the corresponding quarter (ABSCAR), indicator of the negative sign of the cumulative abnormal return (NEGCAR), and earnings surprise (ESUR). Prior research supports the positive association between managers' extent of disclosure and firm size due to larger firms' ability to sustain a competitive advantage from its market power or positional advantages, as well as superior financial and human resources endowments (Ajinkya et al. 2005; Botosan 1997). We control for the size of the firm (SIZE), using the natural log of market capitalization at the end of the quarter (Kothari et al. 2009). Market to book ratio (MB) captures the growth potential perceived in the market, which is related to the information risk. We calculate MB as the market capitalization divided by total shareholders' equity at the end of the quarter to control for firm growth (Kothari et al. 2009).

Another determinant of adopting XBRL is associated with a firm's financial status. Past research found that financial reporting errors are negatively associated with performance (Defond and Jiambalvo 1991) and that the existence of a loss is positively associated with impairing the market's ability to forecast the upcoming earnings number (Heflin et al. 2009). We control for a firm's financial loss (LOSS), measured as 1 if the income before extraordinary items is less than zero, otherwise 0. In addition, financial risks increase as a firm's financial leverage increases (Kothari et al. 2009); and highly leveraged firms tend to disclose more financial information to reassure creditors and to signal their confidence to the public security markets (Malone et al. 1993). Thus, we include the ratio of long-term debt divided by total assets (LEV).

We also control for inherent price variability (Heflin et al. 2003), such as return volatility (RETVAR), which measures the standard deviation of a firm's daily stock returns during the market model estimation period for the relevant pre-XBRL quarter, and also controls for firm-specific inherent price variability. We include the absolute cumulative abnormal return during the entire quarter (ABSCAR), as firm-quarters with larger total information flow are expected to have a larger information gap at any given time (Heflin et al. 2003). For another dimension of price variability, we control for the negative sign of the cumulative abnormal return (NEGCAR), as evidence suggests greater price movements in down markets than in up markets (Christie 1982; Heflin et al. 2003). Following You and Zhang (2009), we consider the earnings surprises (ESUR), which affect future stock returns. We first calculate ESUR from analysts' forecasts, which is the actual EPS minus IBES consensus forecasts scaled by stock price at the end of the quarter. We use the number of analysts following (NUM) as an additional control variable: that being estimated by the average number of analysts for 30 days after the SEC filing date. To reduce the possibility that our inferences are influenced by extreme observations, we winsorize all continuous variables at the 99th percentiles of the distributions of their absolute values.

Research Design

We use the regression models in Equations (1-3) to test our sets of first hypotheses, which assess the effects of the XBRL disclosures in various information risks (see Panel A of Table 4):

$$\text{ERV (or IE)} = \alpha_1 + \alpha_2\text{XBRL} + \alpha_3\text{SIZE} + \alpha_4\text{MB} + \alpha_5\text{LOSS} + \alpha_6\text{LEV} + \alpha_7\text{RETVAR} + \alpha_8\text{ABSCAR} + \alpha_9\text{NEGRET} + \alpha_{10}\sum \text{Industry} + \varepsilon_t \quad (1)$$

$$\text{VR} = \alpha_1 + \alpha_2\text{XBRL} + \alpha_3\text{SIZE} + \alpha_4\text{MB} + \alpha_5\text{LOSS} + \alpha_6\text{LEV} + \alpha_7\text{RETVAR} + \alpha_8\sum\text{Industry} + \varepsilon_t \quad (2)$$

$$\text{AFE} = \alpha_1 + \alpha_2\text{XBRL} + \alpha_3\text{SIZE} + \alpha_4\text{MB} + \alpha_5\text{LOSS} + \alpha_6\text{LEV} + \alpha_7\text{RETVAR} + \alpha_8\text{ESUR} + \alpha_9\text{NUM} + \alpha_{10}\sum\text{Industry} + \varepsilon_t \quad (3)$$

Our primary variable of interest is XBRL, which equals 1 if the firm compiled financial statements in the XBRL format during the mandatory time period (e.g., June 15, 2009), otherwise 0. We compare the effect of 10-K (10-Q) filing in the pre- vs. post- XBRL periods on information risks. For each of the 756 firms, we find a corresponding non-XBRL quarter one year prior to the XBRL quarters. The non-XBRL quarters are used as benchmarks. We expect a negative coefficient on XBRL, which indicates that firms adopted XBRL (Post-XBRL) have lower information risk measures than the same firms one year prior to the XBRL disclosure quarters (Pre-XBRL).

The sets of our second hypothesis examine the impact of XBRL on information complexity in Equations (4-6). To proxy the complexity, we use the absolute value of earnings surprise for the corresponding quarter (ESUR_ABS). Next, we introduce the two-way interaction terms of firm ESUR_ABS with indicator variable XBRL (ESUR_ABS_X) to distinguish the persistence of firm ESUR_ABS for firms of XBRL disclosures (see Panel B of Table 4):

$$ERV \text{ (or IE)} = \alpha_1 + \alpha_2 XBRL + \alpha_3 SIZE + \alpha_4 MB + \alpha_5 LOSS + \alpha_6 LEV + \alpha_7 RETVAR + \alpha_8 ABSCAR + \alpha_9 NEGRET + \alpha_{10} ESUR\_ABS + \alpha_{11} ESUR\_ABS\_X + \alpha_{12} \sum Industry + \varepsilon_t \quad (4)$$

$$VR = \alpha_1 + \alpha_2 XBRL + \alpha_3 SIZE + \alpha_4 MB + \alpha_5 LOSS + \alpha_6 LEV + \alpha_7 RETVAR + \alpha_8 ESUR\_ABS + \alpha_9 ESUR\_ABS\_X + \alpha_{10} \sum Industry + \varepsilon_t \quad (5)$$

$$AFE = \alpha_1 + \alpha_2 XBRL + \alpha_3 SIZE + \alpha_4 MB + \alpha_5 LOSS + \alpha_6 LEV + \alpha_7 RETVAR + \alpha_8 NUM + \alpha_8 ESUR\_ABS + \alpha_9 ESUR\_ABS\_X + \alpha_{10} \sum Industry + \varepsilon_t \quad (6)$$

We expect a positive coefficient on ESUR_ABS because the information risk measures would be higher when the information environment is more complex. Our variable of interest is the interaction term of ESUR_ABS and XBRL as ESUR_ABS_X. We expect a negative coefficient on ESUR_ABS_X because firms that adopted XBRL are expected to mitigate the increase in the information risk measures, especially when information is complex in the market.

IV. RESULTS

Descriptive Results

Table 2 presents the descriptive statistics of our sample, split by firms' post-XBRL adoption (Post-XBRL) compared to the same firms in the corresponding quarter one year prior to the date of XBRL adoption (Pre-XBRL). This analysis presents statistical tests of differences in the cross-sectional mean of ERV, IE (*h* = -1), IE (*h* = -2), VR, and AFE between the pre- and post- XBRL adoption. If XBRL improved the information environment by reducing users' analysis preparation time and cost, allowing them to compare XBRL-tagged data across various organizations, we predict declines in returns volatility and increases in information efficiency. Consistent with our expectation, we find significant decrease in ERV, IE (*h* = -1), IE (*h* = -2), and VR (p = 0.01). However, for AFE, we do not find any significant effect after XBRL adoption. The results should be interpreted cautiously because we do not control for any intervening effects.

[Insert Table 2]

Table 3 presents Pearson correlations for the variables in the study. Our dependent variables represent a different type of information risk measures. Thus, the high correlations among them are expected. All dependent variables, except for AFE, are highly correlated. The correlation between ERV and IE (*h* = -1) is 0.755, and the correlation between ERV and VR is 0.153. None of the correlations among the independent variables are above 0.65, and the highest variance inflation factor (VIF) in our regression is only 3.96, which is well below the suggested multicollinearity problem threshold of 10 (Marquandt 1980; Gujarati 1995). Our examination of the standard errors and size of the coefficients also shows that they are not sensitive to the inclusion or exclusion of the highly correlated variables, indicating that multicollinearity is unlikely to be problematic (Hosmer and Lemeshow 1989).

[Insert Table 3]

Regression Results

Panel A of Table 4 shows our regression results. Our variable of interest is XBRL. Based on H1, we predict a negative coefficient on XBRL (i.e., XBRL adoption lowers information risk). In the first column, XBRL is negative and significant (t-stat.= -6.01, p< 0.01), suggesting that ERV is significantly lower after XBRL adoption, given controlling for numerous factors that relate to ERV including industry effect. We find similar results when the dependent variable is information efficiency [IE (*h* = -1) and IE (*h* = -2)], suggesting information environments become more efficient after XBRL adoption (t-stat. range between -5.55 and -5.22, p<0.01). As shown in the fourth column, XBRL is significantly negative (t-stat.= -6.47, p<0.01) when VR is used as a dependent variable. It indicates that the return volatility for 30 days after the SEC filing date is significantly lower after XBRL adoption. In the last column, we do not find a significant result using AFE. Taken together, these results lend support to sets of H1 and support the view that XBRL decreases information risk.

Panel B of Table 4 report the regression results related to H2. In these regressions, we include the absolute value of earnings surprise (ESUR_ABS) and an interaction term between XBRL and ESUR_ABS. In the ERV model reported in the first column, XBRL is negative and significant (t-stat.= -5.81, p<0.01), ESUR_ABS and the interaction term (ESUR_ABS_X) are significant (t-stat.= 2.67, p<0.01 and t-stat.= -2.38, p<0.05). In the information efficiency models [IE (*h* = -1) and IE (*h* = -2)], XBRL is negative and significant (t-stat. range between -5.17 and -4.76, p<0.01), but ESUR_ABS (ESUR_ABS_X) is positive (negative) and insignificant. In the VR model, we find similar results. We do not find a significant coefficient on the interaction term. In the last column using the AFE model, XBRL is not significant, but ESUR_ABS is positively significant (t-stat. = 4.27, p<0.01) and ESUR_ABS_X is negatively significant (t-stat.= -2.92, p<0.01). These results indicate that the dispersion of analyst forecasts increases when information complexity is high, and that the increase in the dispersion can be mitigated by XBRL adoption. Our evidence marginally supports sets of H2, suggesting that XBRL adoption mitigates the increase in information risk due to information complexity.

[Insert Table 4]

Robustness Checks

Alternative Control Group

Our current research design uses all firms in *Compustat* that provide financial information from two different quarters of the same firm (e.g., the pre- vs.post- XBRL periods) by controlling potential compounding within-firm-level effects. A potential disadvantage of this procedure is that we are not comparing firms of similar characteristics. As an additional robustness check, we construct a matched-pair control group by the propensity score matching approach (PSM, hereafter). First we sample 365 of the first filers only. For every XBRL filing firm, we identify a similar firm based on fiscal year, industry (at 2-digit SIC code), firm size (market capitalization), market-to-book ratio, and profitability (ROA). Additionally, 39 observations are deleted because we cannot find a close match for them.

We then re-estimate our main models, and the results in Panel A of Table 5 yield virtually identical results as those reported in Panel A of Table 4, except for the VR model. In the VR model, RETVAR is dominantly significant. In Panel B of Table 5, we find that ESUR_ABS_X is negative and significant only in the information efficiency models [IE (h = -1) and IE (h = -2)]. There are a couple of potentials that may explain the results. PSM cannot provide a better design in this study because all large firms should use XBRL. Using the PSM, we might compare between large firms and mid (or small) firms. Therefore, we believe that the comparison between a firm's post- XBRL filing quarter and pre- XBRL filing quarter is relatively better controlled for any potential compounding firm-level effects in our setting than the PSM design.

[Insert Table 5]

Potential Earnings Releases

Li and Ramesh (2009) document a stronger stock price movement when firms concurrently issue an earnings press release. To control for concurrent earnings releases, we add the indicator variable (EA) which is equal to 1 when the firm's earnings are concurrently announced on the date of SEC filing. Panel A of Table 6 shows that 39.1% of our sample announced earnings prior to the SEC filing date, while 60.9% of the firms concurrently announced earnings. The coefficient of EA is significantly positive in most of the models, which is consistent with the results of Li and Ramesh (2009). As shown in Table 6, the results indicate that XBRL adoption reduces the information risk, very closely matching the results of Table 4.

[Insert Table 6]

Accounting for Corporate Governance

We further examine whether corporate governance as a whole is associated with information risk in the market (e.g., Ajinkya et al, 2005 and Kothari et al., 2009). For this examination, we use the governance score (G-index), created by Brown and Caylor (2006)[10] where a lower score indicates weaker corporate governance. The results (not tabulated) show that the coefficient on G-index is negative in all models, but significant ($p < 0.05$) only when IE is used as the dependent variable. The coefficient on XBRL is negatively significant, and ESUR_ABS is significantly positive while ESUR_ABS_X is significantly negative in the same

[10] We appreciate Larry Brown and Marcus Caylor for providing the governance data at http://www.robinson.gsu.edu/accountancy/gov_score.html.

models. Overall, the results are similar to those in Table 4. Inclusion of the additional governance variable in our models did not influence our primary results.

V. CONCLUSIONS

Research on XBRL in the field of Accounting and Information Systems (AIS) shows the importance of a catalyst that brings together the different parties to increase transparency, stewardship and smooth functioning of capital markets. Since firms are required to provide interactive data, users can directly extract XBRL-tagged data from corporate or regulatory sites. XBRL not only reduces users' analysis preparation time and cost, but also allows them to easily compare XBRL-tagged data across various organizations. Our investigation into XBRL and its capabilities lead us to believe that XBRL's information clarity and capability to provide a standardized method to prepare, publish, and exchange business information make it an essential tool for market participants.

Our study explores the effects of XBRL adoption on information risk (event returns volatility, information efficiency, standard deviation of daily stock returns, and analysts forecast errors) before and after the XBRL mandated date. Our findings suggest that firms that have adopted XBRL disclosures have the potential to decrease information risk and information asymmetry due to the improved transparent, real time financial reporting in standard XBRL taxonomies. In addition, we find that XBRL marginally mitigates the increase in information risk in the market when there is increased complexity in the information environment. The results are robust to alternative control groups (e.g., a matched-pair control group in the post-XBRL years) and controls for other characteristics, such as potential earnings release and corporate governance. Overall, our findings are consistent with the notion that XBRL disclosures provide value-relevant information to the capital market by enhancing the transparency, comparability, and overall quality of corporate information.

This study does, however, have several limitations. First, firms that terminate their securities registration or delay the filing of their 10-K reports in XBRL are excluded from the sample. It is not clear how the addition of these firms would affect the result of the study. Second, given the relatively short period of time used (approximately seven months from the XBRL mandated date) since XBRL adoption, further examination should be undertaken to ensure the ability to generalize the results. Third, we cannot entirely rule out the possibility of omitted correlated variables. Potential unobserved factors, such as IT intensity, IT experience, and several new areas of IT investments that are correlated with information risks may also drive the positive effects of these findings.

This study offers researchers, as well as professionals, a deeper understanding of how and why capital markets respond to a host of AIS issues. In particular, our results provide insight into how XBRL is used with specific information technology that incorporates both financial and non-financial information. For the AIS researcher, we find compelling evidence that XBRL adoption reduces information risk and information asymmetry in both general and complex information environments. Our findings could establish an empirical and theoretical foundation for accelerating the adoption of XBRL in other countries. The findings of this study should be important to business managers, particularly as the factors of decreased information risk suggest the means for enhancing valuation quality and decreasing capital costs for firms. Our evidence may also be of special interest to policymakers and auditors since the completeness of the XBRL taxonomies as well as the proliferation of multiple taxonomies continue to be a concern (Bonsón et al. 2009; Swanson et al. 2007). This early evidence of the benefits gained from XBRL adoption supports standard setters and regulators who require an empirical evidence for developing effective policies that encourage constructive and definitive internal reporting processes.

REFERENCES

Aguilar, M. K. 2008. The Early Questions on XBRL Adoption. Available at: http://www.complianceweek.com/article/4162/the-early-questions-on-xbrl-adoption

Ajinkya, B., S. Bhojarj, and P. Sengupta. 2005. The association between outside directors, institutional investors and the properties of management earnings forecasts. *Journal of Accounting Research* 43 (3): 343–376.

American Institute of Certified Public Accountants (AICPA). 2009. Benefits and Potential Uses of XBRL. Available at: http://www.aicpa.org/InterestAreas/AccountingAndAuditing/Resources/XBRL/Pages/BenefitsandPotentialUsesofXBRL.aspx

Apostolou, A. K., and K. A. Nanopoulos. 2009. Interactive financial reporting using XBRL: an overview of the global markets and Europe. *International Journal of Disclosure and Governance* 6 (3):261-272.

Bailey, W., H. Li, C. Mao, and R. Zhong. 2003. Regulation fair disclosure and earnings information: market, analyst, and corporate responses. *Journal of Finance* 58: 2487–2514.

Bartley, J., Y. S. A. Chen, and E. Taylor. 2010. Avoiding Common Errors of XBRL Implementation. *Journal of Accountancy* 209 (2):46-51.

Bergeron, B. P. 2003. *Essentials of XBRL: Financial Reporting in the 21st Century*. New York: John Wiley and Sons.

Boritz, J. E., and W. G. No. 2008. The SEC's XBRL Voluntary Filing Program on EDGAR: A Case for Quality Assurance. *Current Issues in Auditing* 2 (2):A36-A50.

Boritz, J. E., and W. G. No. 2009. Assurance on XBRL-Related Documents: The Case of United Technologies Corporation. *Journal of Information Systems* 23 (2):49-78.

Botosan, C.A. Disclosure level and the cost of equity capital. *The Accounting Review* 20 (3): 421–439.

Cohen, E. E., T. Schiavina, and O. Servais. 2005. XBRL: The standardised business language for 21st century reporting and governance. *International Journal of Disclosure and Governance* 2 (3):368-394.

Cox, C. 2006. The Interactive Data Revolution: Improved Disclosure for Investors, Less Expensive Reporting for Companies. Available at: http://www.sec.gov/news/speech/2006/spch053006cc.htm

Doolin, B., and I. Troshani. 2007. Organizational Adoption of XBRL. *Electronic Markets* 17 (3):199-209.

Debreceny, R. S., A. Chandra, J. J. Cheh, D. Guithues-Amrhein, N. J. Hannon, P. D. Hutchison, D. Janvrin, R. A. Jones, B. Lamberton, A. Lymer, M. Mascha, R. Nehmer, S. Roohani, R. P. Srivastava, S. Trabelsi, T. Tribunella, G. Trites, and M. A. Vasarhelyi. 2005. Financial Reporting in XBRL on the SEC's EDGAR System: A Critique and Evaluation. *Journal of Information Systems* 19 (2):191-210.

Debreceny, R., and S. Farewell. 2010. Adios! Airways: An Assignment on Mapping Financial Statements to the U.S. GAAP XBRL Taxonomy. *Issues in Accounting Education* 25 (3):465-488.

Debreceny, R., S. Farewell, M. Piechocki, C. Felden, and A. Gräning. 2010. Does it add up? Early evidence on the data quality of XBRL filings to the SEC. *Journal of Accounting and Public Policy* 29 (3):296-306.

DeFond, M., and J. Jiambalvo. 1991. Incidence and circumstances of accounting errors. The *Accounting Review* 66: 643–655.

Eccles, R., R. Herz, E. Keegan, and D. Phillips. 2001. The Value Reporting™ Revolution. New York: John Wiley & Sons, Inc.

Federal Financial Institutions Examination Council (FFIEC). 2006. Improved Business Process Through XBRL: A Use Case for Business Reporting. Available at: http://www.xbrl.org/us/us/FFIEC%20White%20Paper%2002Feb2006.pdf

Francis, J., N. Dhananjay, and X. Wang. 2006. Re-examining the effects of regulation fair disclosure using foreign listed firms to control for concurrent shocks. *Journal of Accounting and Economics* 41: 271-292.

Garbellotto, G. 2009. How to Make Your Data Interactive. *Strategic Finance* 90 (9):56-57.

Gray, G. L., and D. W. Miller. 2009. XBRL: solving real-world problems. *International Journal of Disclosure and Governance* 6 (3):207-223

Gujarati, D. N. 1995. *Basic Econometrics: Third Edition*. New York, NY: McGraw-Hill.

Heflin, F., K.R. Subramanyam, and Y. Zhang. 2003. Regulation FD and the financial information environment: Early evidence. *The Accounting Review* 78 (1): 1–37.

Hodge, F.D., J. J. Kennedy, and L. A. Maines. 2004. Does search-facilitating technology improve the transparency of financial reporting? *The Accounting Review* 79 (3): 687–703.

Hoffman, C., and C. Strand. 2001. *XBRL Essentials*. New York: AICPA.

Hosmer, D., and S. Lemeshow. 1989. *Applied Logistic Regression*. New York, NY: John Wiley & Sons.

Kim, O., and R. Verrecchia. *1994.* Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics* 17 (1-2): 41-67.

Kothari, S.P., X. Li, and J.E. Short. 2009. The effect of disclosures by management, analysts, and business press on cost of capital, return volatility, and analyst forecasts: A study using content analysis. *The Accounting Review* 84 (5): 1639–1670.

Li, E. X., and K. Ramesh. 2009. Market reaction surrounding the filing of periodic SEC reports. *The Accounting Review* 84 (4): 1171-1208.

Malone, D., C. Fries, and T. Jones. 1993. An empirical investigation of the extent of corporate financial disclosure in the oil and gas industry. *Journal of Accounting, Auditing and Finance* 8: 249–73.

Marquandt, D. 1980. You should standardize the predictor variables in your regression models. Discussion of: A critique of some ridge regression methods. *Journal of the American Statistical Association* 75: 87–91.

Nicolaou, A.I., A. T. Lord, and L. Liu. 2003. Demand for Data Assurances in Electronic Commerce: An Experimental Examination of a Web-based Data Exchange Using XML. In *Trust and Data Assurances in Capital Markets: The Role of Technology Solutions*, edited by S. J. Roohani. Smithfield, RI: Bryant College and PricewaterhouseCoopers, 32-42.

Pinsker, R., and S. Li. 2008. Costs and Benefits of XBRL Adoption: Early Evidence. *Communications of the ACM* 51 (3):47-50.

Plumlee, R. D., and M. A. Plumlee. 2008. Assurance on XBRL for Financial Reporting. *Accounting Horizons* 22 (3):353-368.

Premuroso, R.F., and S. Bhattacharya. 2008. Do early and voluntary filers of financial information in XBRL format signal superior corporate governance and operation performance? *International Journal of Accounting Information Systems* 9: 1–20.

Roohani, S., Y. Furusho, and M. Koizumi. 2009. XBRL: improving transparency and monitoring functions of corporate governance. *International Journal of Disclosure and Governance* 6 (4):355-369.

Securities and Exchange Commission (SEC). 2008. SEC approves interactive data for financial reporting by public companies, mutual funds. Available at: http://www.sec.gov/news/press/2008/2008-300.htm.

———. 2009. Interactive data to improve financial reporting. Available at: http://www.sec.gov/rules/final/2009/33-9002.pdf.

———. 2010a. Staff Observations From Review of Interactive Data Financial Statements. Available at: http://www.sec.gov/spotlight/xbrl/staff-review-observations.shtml

———. 2010b. What Is Interactive Data and Who's Using It? Available at: http://www.sec.gov/spotlight/xbrl/what-is-idata.shtml

Software AG. 2002. XBRL: Understanding the XML Standard for Business Reporting and Finance. Available at: http://www.xbrl.org/Business/General/SoftwareAG-CaseForXBRL.pdf

Tribunella, T., and H. Tribunella. 2010. Using XBRL to Analyze Financial Statements. *The CPA Journal* 80 (3):69-72.

Weirich, T. R., and S. A. Harrast. 2010. XBRL Filings: What Have We Learned? *Journal of Corporate Accounting & Finance* 21 (5):35-39.

Willis, M., B. Tesnière, and A. Jones. 2003. Corporate communications in the 21st Century Available at: http://www.xbrl.org/Business/General/PwC-Corp-Comms-21st-Century-2002-10.pdf

XBRL International. White Paper, 2002.

XBRL International. 2007. Frequently Asked Questions. XBRL International. Available at: http://www.xbrl.org/faq.aspx

XBRL US. 2010. Avoiding Common Errors in XBRL Creation. Available at: http://xbrl.us/research/documents/AvoidingErrorsWhitePaper.pdf

XBRL US. 2009. Fact Sheets. Available at: http://xbrl.us/Learn/Pages/FactSheet.aspx

Yoon, H., H. Zo, and A. P. Ciganek. 2010. Does XBRL adoption reduce information asymmetry? *Journal of Business Research*.

You, H., and X. Zhang. 2009. Financial reporting complexity and investor underreaction to 10-K information. Review of Accounting Studies 14 (4): 559-586.

FIGURE 1
XBRL Tagging Example

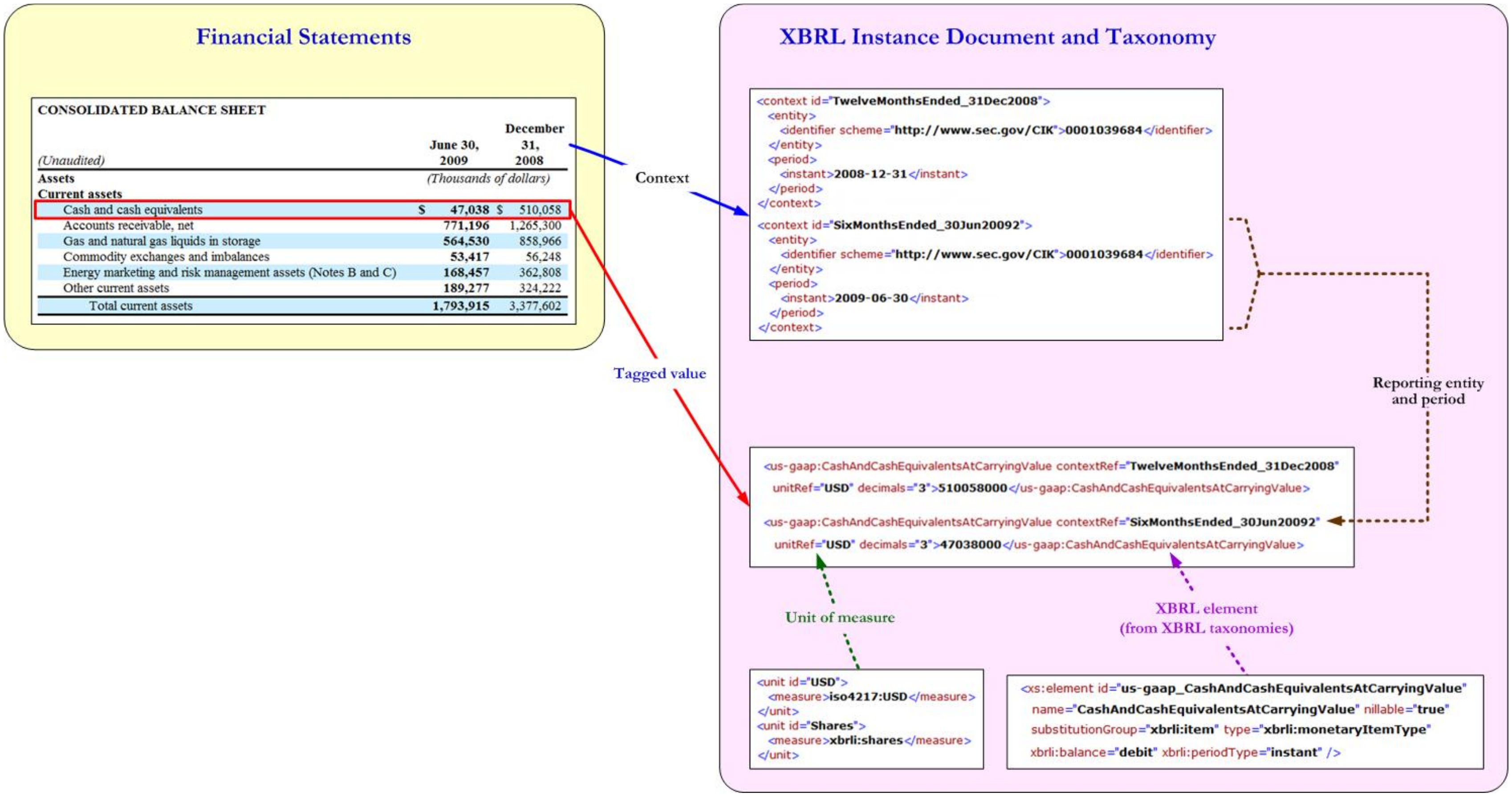

FIGURE 2
An Example: Ratio Analysis using XBRL-tagged Information

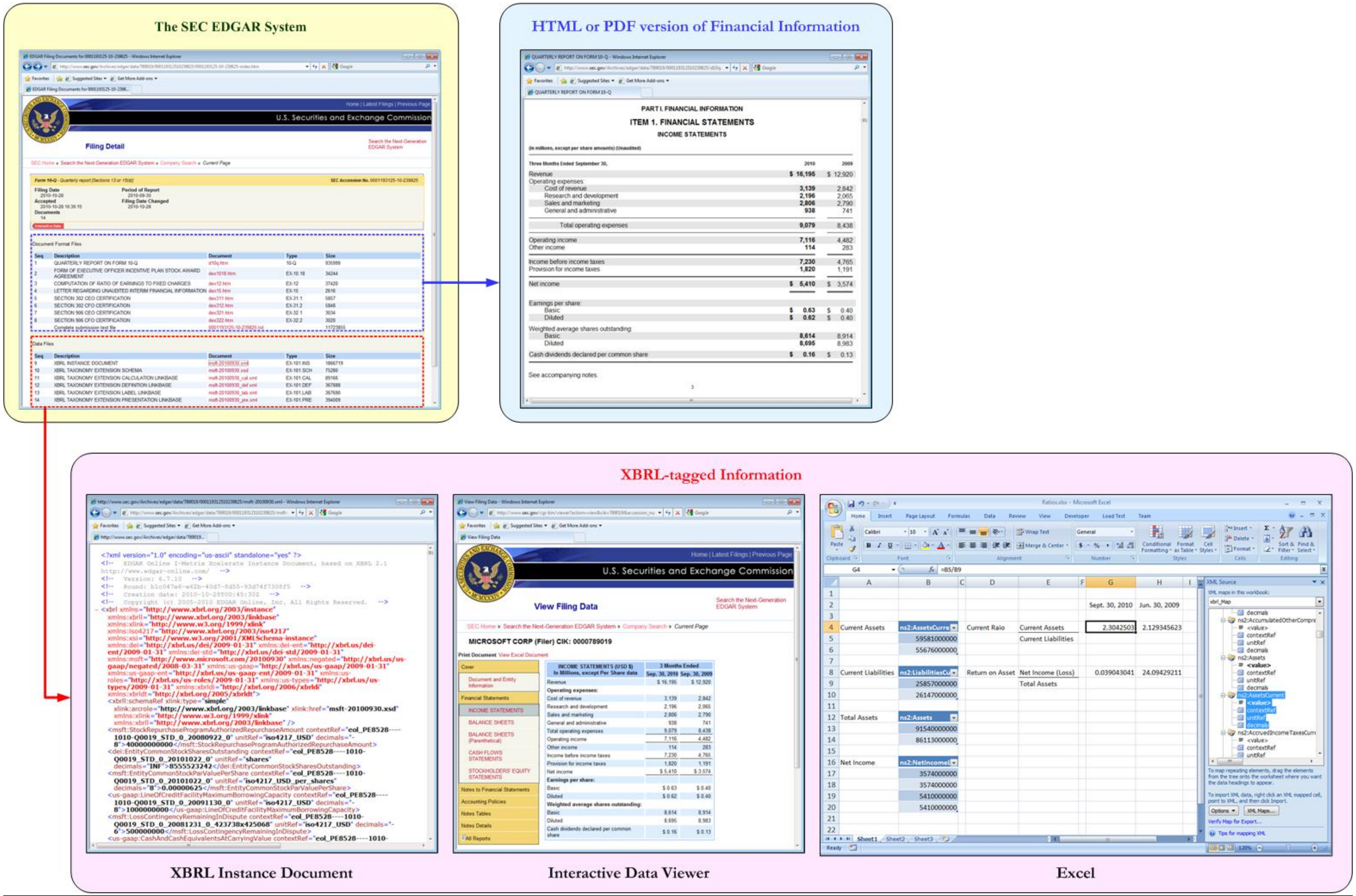

TABLE 1

Panel A: Sample Selection Procedure

Step 1	Start from EDGAR RSS Feeds Interactive data submissions		933
Step 2	Exclude Not 10-Q and 10-K submissions	(17)	
Step 3	Exclude from Not the large accelerated U.S. GAAP filers, Missing values from *Compustat, CRSP*, or *I/B/E/S*	(160)	
	Final Sample		**756**

Panel B: Distribution of Sample by 2-digit SIC

2-digit SIC	**Industry**	**No.**	**%**
10-19	Mining, Oil and Gas, and others	88	11.6
20-27	Food, Kindred, Printing and Publishing	46	6.1
28-29	Chemicals, Petroleum and Coal, Rubber and Plastics	76	10.1
30-39	Metal, Machinery and Equipment, Instruments	181	23.9
40-49	Utility, Transportation	107	14.2
50-59	Whole Sale, Retails	65	8.6
60-69	Banking and Finance	121	16.0
70-79	Business Service, Auto Repair, Recreation	56	7.4
80-89	Health, Engineering and Management Service	13	1.8
99	Others	3	0.3
Total		756	100

Table 2

Descriptive Statistics
After SEC filing dates before and after XBRL required (Pre- vis. Post- XBRL adoption)

	Pre-XBRL (N=756)			Post-XBRL (N=756)			P-value for the test of Difference in	
	Mean	**Median**	**s.d.**	**Mean**	**Median**	**s.d.**	**Means**	**Median**
ERV	0.051	0.044	0.039	0.045	0.036	0.036	0.001	0.000
IE(*h* = -1)	0.037	0.028	0.037	0.032	0.025	0.031	0.003	0.004
IE(*h* = -2)	0.040	0.031	0.038	0.035	0.026	0.034	0.006	0.003
VR	0.002	0.002	0.008	-0.004	-0.003	0.007	0.000	0.000
AFE	0.000	0.000	0.001	0.000	0.000	0.002	0.081	0.298
XBRL	0	0	0	1	1	0	NA	NA
SIZE	9.620	9.571	1.054	9.248	9.118	1.036	0.000	0.000
MB	3.879	3.244	2.247	2.669	2.087	1.960	0.000	0.000
LOSS	0.037	0.000	0.189	0.123	0.000	0.329	0.000	0.000
LEV	0.192	0.163	0.155	0.214	0.201	0.157	0.008	0.003
RETVAR	0.016	0.015	0.005	0.038	0.034	0.018	0.000	0.000
ABSCAR	0.142	0.110	0.122	0.322	0.270	0.244	0.000	0.000
NEGRET	0.413	0.000	0.493	0.837	1.000	0.369	0.000	0.000
ESUR	0.001	0.000	0.003	0.002	0.001	0.011	0.006	0.000
NUM	2.664	2.773	0.456	2.721	2.773	0.469	0.015	0.007
ESUR_ABS	0.001	0.001	0.003	0.004	0.002	0.010	0.000	0.000
ESUR_ABS_X	0	0	0	0.004	0.002	0.010	0.000	0.000

Variable Definitions:

ERV = the sum of absolute abnormal returns on one day prior to the SEC filing date, on the SEC filing date, and on one day after the SEC filing date;

IE(*h* = -1) = the absolute abnormal return from one day prior to the SEC filing date to two days after the SEC filing date;

IE(*h* = -2) = the absolute abnormal return from two days prior to the SEC filing date to two days after the SEC filing date;

VR = the standard deviation of daily stock returns over 30 days before (or after) the SEC filing date;

AFE = the standard deviation of analysts' forecasts before (or after) the SEC filing date, divided by the stock price;

XBRL = an indicator equal to 1 if the observation belongs to the XBRL filing period, otherwise 0;

SIZE = the log of the market value of firm at the end of the quarter;

MB = the market-to-book ratio at the end of the quarter;

LOSS = an indicator variable equal to 1 for observations with negative earnings before extraordinary items in the quarter, 0 otherwise;

LEV = the long-term debt divided by total assets;

Return volatility (RETVAR) = the standard deviation of daily stock return for a one-year period starting from 55 days prior to the filing date;

ABSCAR = the absolute value of cumulative abnormal return for the corresponding quarter. It is used to control the amount of information inflow for the period;

NEGCAR = the sign of the cumulative abnormal return used for ABSCAR;

EA = 1 if the earnings is announced on the date of SEC filing, otherwise 0;

ESUR = actual earnings minus the mean of analysts' forecasts divided by stock price at the end of a fiscal quarter;

NUM = natural log of (1+ the number of analysts following firm);

ESUR_ABS = the absolute value of ESUR;

ESUR_ABS_X = the interaction between ESUR_ABS and XBRL.

TABLE 3
Pearson Correlation Matrix
After SEC filing dates Before and After XBRL required (Pre- XBRL vs. Post- XBRL, 756 obs.)

Variables	ERV	IE(*h*=-1)	IE(*h*=-2)	VR	AFE	XBRL	SIZE	MB	LOSS	LEV	RETVAR	ABSCAR	NEGRET	ESUR	NUM	ESUR_ABS
ERV	1															
IE(*h*=-1)	0.755*	1														
IE(*h*=-2)	0.692*	0.863*	1													
VR	0.153*	0.163*	0.128*	1												
AFE	0.029	0.033	0.025	0.036	1											
XBRL	-0.082*	-0.077*	-0.070*	-0.366*	-0.045	1										
SIZE	-0.151*	-0.104*	-0.111*	0.120*	0.022	-0.175*	1									
MB	0.078*	0.092*	0.098*	0.075*	0.021	-0.276*	0.151*	1								
LOSS	0.033	0.019	-0.002	-0.081*	-0.057*	0.158*	-0.139*	-0.111*	1							
LEV	-0.016	-0.017	-0.021	-0.017	0.048	0.069*	-0.144*	-0.044	0.082*	1						
RETVAR	0.157*	0.122*	0.123*	-0.284*	-0.085*	0.634*	-0.344*	-0.294*	0.329*	0.059*	1					
ABSCAR	0.107*	0.078*	0.076*	-0.181*	0.037	0.424*	-0.195*	-0.141*	0.109*	0.041	0.439*	1				
NEGRET	-0.043	-0.035	-0.033	-0.163*	0.016	0.439*	-0.030	-0.165*	0.012	0.068*	0.159*	0.250*	1			
ESUR	0.022	0.010	0.000	-0.059*	0.028	0.071*	-0.024	-0.060*	-0.092*	0.006	0.168*	0.104*	-0.032	1		
NUM	-0.047	-0.056*	-0.073*	-0.105*	0.006	0.062*	0.386*	0.095*	0.035	-0.324*	-0.011	0.003	-0.049	-0.013	1	
ESUR_ABS	0.077*	0.061*	0.056*	-0.122*	0.012	0.166*	-0.128*	-0.168*	0.171*	0.107*	0.414*	0.173*	-0.007	0.606*	-0.091*	1

* Significant at the 0.05 level using a two-tailed t- test, respectively.

TABLE 4
Regression of Information Risk Measures on XBRL and Control Variables

Panel A: Effect of XBRL

	ERV			**IE(*h* = -1)**			**IE(*h* = -2)**			**VR**			**AFE**		
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	
INTERCEPT	0.070	4.52	***	0.046	3.07	***	0.061	4.07	***	0.009	2.52	**	0.001	1.61	
XBRL	-0.021	-6.01	***	-0.017	-5.55	***	-0.017	-5.22	***	-0.004	-6.47	***	0.000	0.15	
SIZE	-0.005	-4.00	***	-0.003	-2.79	***	-0.004	-3.30	***	0.000	-0.33		0.000	-0.52	
MB	0.003	2.63	***	0.003	3.04	***	0.003	3.43	***	0.000	-0.05		0.000	-0.55	
LOSS	-0.003	-0.86		-0.004	-1.32		-0.008	-2.35	**	0.000	-0.26		0.000	-0.91	
LEV	-0.009	-0.93		-0.012	-1.40		-0.017	-1.99	**	-0.003	-1.40		0.001	2.16	**
RETVAR	0.584	4.18	***	0.512	4.29	***	0.555	4.17	***	-0.082	-3.83	***	-0.008	-1.16	
ABSCAR	0.016	2.48	**	0.009	1.64		0.008	1.45							
NEGRET	0.002	0.89		0.003	1.39		0.004	1.58							
ESUR													0.005	0.65	
NUM													0.000	0.81	
INDUSTRY	Yes			Yes			Yes			Yes			Yes		
F-VALUE	5.22***			3.86***			3.69***			6.96***			1.60***		
Adj. R-sq.	0.146			0.104			0.098			0.189			0.024		
Obs. #	1,512			1,512			1,512			1,512			1,512		

Panel B: Effect of XBRL and Uncertainty

	ERV			**IE(*h* = -1)**			**IE(*h* = -2)**			**VR**			**AFE**		
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	
INTERCEPT	0.067	4.28	***	0.043	2.87	***	0.057	3.81	***	0.008	2.30	**	0.001	1.31	
XBRL	-0.020	-5.81	***	-0.016	-5.17	***	-0.016	-4.76	***	-0.004	-6.48	***	0.000	0.86	
SIZE	-0.005	-3.95	***	-0.003	-2.75	***	-0.003	-3.25	***	0.000	-0.22		0.000	-0.51	
MB	0.003	2.67	***	0.003	3.08	***	0.003	3.47	***	0.000	-0.14		0.000	-0.20	
LOSS	-0.004	-0.96		-0.004	-1.43		-0.008	-2.45	**	0.000	-0.27		0.000	-1.15	
LEV	-0.011	-1.15		-0.014	-1.62		-0.019	-2.20	**	-0.003	-1.43		0.001	1.80	*
RETVAR	0.610	4.13	***	0.536	4.54	***	0.581	4.28	***	-0.067	-2.85	***	-0.008	-1.32	
ABSCAR	0.016	2.46	**	0.009	1.62		0.008	1.43							
NEGRET	0.002	0.84		0.003	1.33		0.003	1.51							
NUM													0.000	0.93	
ESUR_ABS	0.876	2.67	***	0.864	1.35		0.893	1.29		0.055	0.69		0.056	4.27	***
ESUR_ABS_X	-0.957	-2.38	**	-0.933	-1.27		-0.969	-1.27		-0.112	-1.39		-0.048	-2.92	***
INDUSTRY	Yes			Yes			Yes			Yes			Yes		
F-VALUE	5.15***			3.83***			3.66***			6.82***			1.78***		
Adj. R-sq.	0.147			0.106			0.100			0.190			0.031		
Obs. #	1,512			1,512			1,512			1,512			1,512		

***, **, * Significant at the 0.01, 0.05, and 0.10 levels using a two-tailed t- test, respectively.
All regressions use Huber-White standard errors adjusted for clustering at the firm level.
Notes: Variables are as defined in Table 2.

TABLE 5
Robustness Check (using the propensity score matching sample)

Panel A: Effect of XBRL

	ERV		**IE(*h* = -1)**		**IE(*h* = -2)**		**VR**		**AFE**	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
INTERCEPT	0.016	0.54	-0.011	-0.48	-0.021	-0.83	0.004	0.76	0.002	1.04
XBRL	-0.013	-2.98 ***	-0.010	-2.58 **	-0.012	-2.68 ***	0.001	0.77	0.000	-0.44
SIZE	-0.001	-0.47	0.001	0.44	0.001	0.60	0.000	0.89	0.000	-0.45
MB	0.003	2.37 **	0.002	1.78 *	0.002	1.79 *	0.000	-0.25	0.000	0.03
LOSS	0.003	0.47	0.006	1.22	0.006	1.12	0.001	0.89	-0.001	-1.53
LEV	-0.014	-1.09	-0.015	-1.31	-0.006	-0.44	0.000	-0.02	0.001	0.52
RETVAR	0.667	4.29 ***	0.504	4.20 ***	0.533	3.95 ***	-0.101	-3.07 ***	0.010	0.82
ABSCAR	0.012	1.24	0.004	0.53	0.007	0.84				
NEGRET	-0.004	-0.87	0.003	0.73	-0.001	-0.19				
ESUR									-0.114	-2.13 **
NUM									0.000	-0.58
INDUSTRY	Yes		Yes		Yes		Yes		Yes	
F-VALUE	2.27***		1.89***		2.02***		1.24		6.70***	
Adj. R-sq.	0.1005		0.0723		0.0819		0.0196		0.3355	
Obs. #	652		652		652		652		652	

Panel B: Effect of XBRL and Uncertainty

	ERV		**IE(*h* = -1)**		**IE(*h* = -2)**		**VR**		**AFE**	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
INTERCEPT	0.017	0.61	-0.012	-0.52	-0.018	-0.72	0.003	0.68	0.001	0.74
XBRL	-0.013	-2.87 ***	-0.008	-2.10 **	-0.009	-1.98 **	0.000	0.19	0.001	1.35
SIZE	-0.001	-0.48	0.001	0.40	0.001	0.52	0.000	0.96	0.000	-0.78
MB	0.003	2.44 **	0.002	1.81 *	0.002	2.04 **	0.000	-0.40	0.000	-0.10
LOSS	0.003	0.54	0.005	1.03	0.005	1.04	0.001	0.99	0.000	-0.86
LEV	-0.013	-1.05	-0.016	-1.36	-0.006	-0.45	0.000	0.00	0.001	0.65
RETVAR	0.629	3.95 ***	0.520	4.26 ***	0.465	3.48 ***	-0.093	-2.64 ***	0.022	1.65 *
ABSCAR	0.012	1.23	0.003	0.44	0.005	0.65				
NEGRET	-0.004	-0.79	0.003	0.81	0.001	0.21				
NUM									0.000	-0.53
ESUR_ABS	0.120	0.32	0.279	0.99	0.809	2.87 ***	-0.111	-2.50 **	0.043	1.02
ESUR_ABS_X	0.005	0.01	-0.356	-1.30	-0.633	-2.14 **	0.098	2.39 **	-0.183	-2.65 ***
INDUSTRY	Yes		Yes		Yes		Yes		Yes	
F-VALUE	2.21***		1.87***		2.16***		1.29*		7.36***	
Adj. R-sq.	0.0989		0.0728		0.0955		0.0246		0.3641	
Obs. #	652		652		652		652		652	

***, **, * Significant at the 0.01, 0.05, and 0.10 levels using a two-tailed t- test, respectively.
All regressions use Huber-White standard errors adjusted for clustering at the firm level.
Notes: Variables are as defined in Table 2.

TABLE 6
Robustness Check (Potential Earnings Releases)

Panel A: Earnings Announcements vs. SEC Filing Dates

	Earnings announced before the SEC filing date	Earnings announced on the date of SEC filing
Number of Obs.	591 (39.1%)	921(60.9%)

Panel B: Effect of XBRL

	ERV			IE(*h* = -1)			IE(*h* = -2)			VR			AFE		
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	
INTERCEPT	0.056	3.73	***	0.036	2.51	**	0.051	3.63	***	0.006	1.68	*	0.001	1.47	
XBRL	-0.022	-6.22	***	-0.017	-5.68	***	-0.018	-5.37	***	-0.004	-6.82	***	0.000	0.10	
SIZE	-0.004	-3.45	***	-0.002	-2.30	**	-0.003	-2.90	***	0.000	0.38		0.000	-0.46	
MB	0.002	2.52	**	0.002	2.98	***	0.003	3.37	***	0.000	-0.42		0.000	-0.66	
LOSS	-0.003	-0.79		-0.004	-1.26		-0.007	-2.32	**	0.000	-0.19		0.000	-0.90	
LEV	-0.008	-0.85		-0.012	-1.35		-0.016	-1.97	**	-0.002	-1.33		0.001	2.19	**
RETVAR	0.590	4.25	***	0.517	4.32	***	0.559	4.22	***	-0.079	-3.79	***	-0.007	-1.15	
ABSCAR	0.017	2.68	***	0.010	1.79	*	0.009	1.58							
NEGRET	0.002	0.77		0.003	1.29		0.003	1.48							
EA	0.012	5.06	***	0.009	3.78	***	0.008	3.49	***	0.002	5.41	***	0.000	1.01	
ESUR													0.005	0.66	
NUM													0.000	0.86	
INDUSTRY	Yes			Yes			Yes			Yes			Yes		
F-VALUE	5.75***			4.15***			3.89***			7.54***			1.58***		
Adj. R-sq.	0.1633			0.1143			0.1059			0.2063			0.0237		
Obs. #	1,512			1,512			1,512			1,512			1,512		

(Continued) Table 6

Panel C: Effect of XBRL and Uncertainty

	ERV			IE(*h* = -1)			IE(*h* = -2)			VR			AFE		
	Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.		Coeff.	t-stat.	
INTERCEPT	0.053	3.49	***	0.033	2.30	**	0.048	3.36	***	0.006	1.49		0.001	1.15	
XBRL	-0.020	-6.03	***	-0.016	-5.30	***	-0.016	-4.90	***	-0.004	-6.80	***	0.000	0.82	
SIZE	-0.004	-3.39	***	-0.002	-2.25	**	-0.003	-2.84	***	0.000	0.49		0.000	-0.44	
MB	0.002	2.57	**	0.002	3.02	***	0.003	3.42	***	0.000	-0.50		0.000	-0.32	
LOSS	-0.003	-0.90		-0.004	-1.37		-0.008	-2.42	**	0.000	-0.21		0.000	-1.15	
LEV	-0.010	-1.08		-0.014	-1.58		-0.018	-2.19	**	-0.002	-1.38		0.001	1.83	*
RETVAR	0.610	4.17	***	0.535	4.56	***	0.580	4.32	***	-0.066	-2.86	***	-0.008	-1.32	
ABSCAR	0.017	2.66	***	0.010	1.77	*	0.009	1.56							
NEGRET	0.002	0.72		0.003	1.23		0.003	1.41							
EA	0.012	5.11	***	0.009	3.82	***	0.008	3.52	***	0.002	5.36	***	0.000	1.07	
NUM													0.000	0.99	
ESUR_ABS	0.895	2.84	***	0.878	1.40		0.906	1.32		0.059	0.77		0.056	4.26	***
ESUR_ABS_X	-0.950	-2.45	**	-0.929	-1.28		-0.965	-1.28		-0.111	-1.44		-0.048	-2.90	***
INDUSTRY	Yes			Yes			Yes			Yes			Yes		
F-VALUE	5.66***			4.11***			3.85***			7.38***			1.76***		
Adj. R-sq.	0.1650			0.1164			0.1078			0.2074			0.0311		
Obs. #	1,512			1,512			1,512			1,512			1,512		

***, **, * Significant at the 0.01, 0.05, and 0.10 levels using a two-tailed t- test, respectively.
All regressions use Huber-White standard errors adjusted for clustering at the firm level.
Notes: Variables are as defined in Table 2.