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RELEASING INFORMATION IN XBRL: DOES IT IMPROVE INFORMATION ASYMMETRY FOR EARLY U. S. ADOPTERS?

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ABSTRACT

Information released in XBRL is intended to improve the quality and accessibility of SEC filings, leading to less information asymmetry in the equity market. Research findings on the effects of XBRL on information asymmetry in the U.S., however, are mixed. Kim et al. (2012) reports that XBRL reduces information asymmetry while Blankespoor et al. (2012) reports that XBRL increases information asymmetry. In contrast to these prior studies, we report that the answer as to whether XBRL affects information asymmetry is matter of firm size. In this study we examine shifts in two measures of information asymmetry for early adopters of XBRL in the U.S. Specifically, we find that the bid-ask spreads of early XBRL adopters significantly decrease after they adopt XBRL; yet, we find no overall change in trading volume associated with XBRL filings for early adopters. However, when examining the larger early adopting firms, we find evidence of reduced information asymmetry (bid-ask spreads significantly decrease and trading volume significantly increase). Our results generally support the SEC requirement of XBRL formatted financial information on the grounds that it may reduce information asymmetry of large filers in the U.S. equity market.

Keywords: XBRL reporting, information asymmetry, bid ask spread, trading volume, firm-size effect

INTRODUCTION

XBRL (eXtensible Business Reporting Language) is a machine-readable language that offers enhanced search and data analysis capabilities that surpass previous reporting languages used for filing financial information in the U.S. (SEC, 2005). The intended purpose of XBRL is to improve the quality of publicly released financial and non-financial corporate information to regulators, stockholders, and the investing public (Plumlee and Plumlee, 2008). In fact, the intent behind the development of XBRL formatting was to improve the accuracy, reliability, and efficiency of analysis of corporate information released to the public (Debreceeny et al. 2005; XBRL US, 2008a), thereby reducing information asymmetry between parties in the capital markets (Healy et al. 1995; Bartov and Bodnar, 1996; Brown and Fernando, 2011). Information asymmetry represents a fundamental imbalance in the capital markets in that one party's information has more quality, quantity, or timeliness than the other party's information in the transaction, (Kulkarni, 2000; Grewala et al. 2003; Biswas, 2004; Brown and Fernando, 2011) therefore enabling the more informed party to attain above average levels of return in the market (Bartov and Bodnar, 1996).

XBRL, however, has its proponents as well as its detractors. Anecdotal evidence suggests that XBRL use may level the information playing field and reduce information asymmetry in the equity market (Harrington, 2005). In contrast, XBRL may increase information asymmetry if only sophisticated investors can process XBRL filings, especially in the initial years of its use (Debreceeny et al. 2005, 2011). These opposing expectations regarding the actual effect of XBRL use in the U.S. raise the empirical question of whether XBRL reduce information asymmetry as claimed by the SEC (2005, 2009), or whether it compounds the problem. Accordingly, we contribute to the sparse, but growing literature on actual market effects associated with the use of XBRL by examining early U. S. adopters of XBRL (i.e., firms adopting XBRL prior to the SEC's mandate) for evidence of changes to their information asymmetry. We observe 366 firm-quarters of early XBRL adopters with XBRL and HTML EDGAR filings on the same date. We also observe an equivalent number of firm-quarters of the same early adopters prior to their XBRL adoption. Specifically, we investigate the effect of firm size while analyzing bid-ask spreads and trading volume of early XBRL adopters in the U.S. before and after their XBRL adoptions.

In one of the few targeted studies in this area, Yoon et al. (2011) assessed bid-ask spreads as their sole measure of information asymmetry in their investigation of the one-time mandatory switch to XBRL reporting in Korea. Their results suggest that XBRL reduced information asymmetry immediately in Korea. Unlike the U.S. equity market, the equity market in Korea does not have designated market makers (Yoon et al. 2011: 158). So, in Korea, most equity transactions are executed directly between sellers and buyers. Whereas in the U.S., most equity transactions involve an intermediary where sellers sell their equities to the intermediary, the intermediary then sells the equities to a buyer. Another contrast between the U.S. and Korean stock markets is that the switch to XBRL in the U.S. was phased-in over multiple periods as opposed to a one-time switch to XBRL like in Korea. Consequently, the results of XBRL reporting in Korea may not be identical to the results observed in the U.S. To date, the effects of XBRL on information asymmetry in the U.S. are mixed. Kim et al. (2012) results suggest reduced information asymmetry as a result of XBRL while Blankespoor et al. (2012) results suggest that XBRL increase information asymmetry.

Our study contributes to this emerging body of research in two ways. First, we present an empirical examination of XBRL formatted information in the U.S. equity market to determine whether XBRL has actually reduced information asymmetry in the U.S. To date, the impact of XBRL in the U.S. has not been fully resolved. In order to more accurately assess the differential impact of XBRL in the U.S., we extend the literature by examining firm-size as a major determinant of XBRL's ability to influence information asymmetry in the U.S. Second, while there are several possible measures of information asymmetry, Yoon et al. (2001) only provide evidence that XBRL reduces bid-ask spreads in Korea. In fact, Bartov and Bodnar (1996) argue that when investigating information asymmetry, trading volume should be simultaneously observed with bid-ask spread. Blankespoor et al. (2012) examine bid-ask spread and trading volume, but their analysis compares XBRL adopters to non-XBRL adopters during the same reporting period. Therefore, we extend the literature by investigating the association between corporate disclosures in the U.S. released using XBRL and the reduction in information asymmetry. We examine bid-ask spreads with trading volume for early XBRL adopters before and after XBRL adoption. Accordingly, the purpose of this study is to strengthen the results in the existing literature and document the ability of XBRL to reduce information asymmetry in the U.S. stock market. That is, we not only expect that XBRL will reduce the difference between

what sellers are willing to accept for their equities, but what buyers are willing to pay for those same equities as well. We also predict that parties will be more willing to participate in equity transactions as a result of XBRL. Additionally, we predict that XBRL will have a stronger impact for larger SEC filers.

Our examination of early adopters (prior to the SEC's mandated graduated implementation dates) find that XBRL significantly reduces overall bid-ask spreads and modestly increases trading volume, the two expected outcomes from lower information asymmetry in the equity market. We also find that these effects are more pronounced for larger SEC filers than for smaller SEC filers. As we move towards implementation of fully interactive XBRL data in 2014 for all filers (SEC, 2009, 43), the results of our study should be of keen interest to U. S. market regulators and standard-setters (e.g., SEC, FASB), as well as market participants, including investors of all sizes and the public corporations required to release information in the XBRL format.

The remainder of this paper is organized as follows. Section II discusses the background of XBRL, while Section III describes the previous literature and develops our hypotheses. Section IV describes the method. Section V presents the findings. Section VI discusses the study's implications.

BACKGROUND

What Is XBRL?

Before XBRL, issuers were required to file their SEC disclosures only in the HTML (Hyper Text Markup Language) format. Both HTML and XBRL are taxonomies, meaning that issuers assign identifying tags to data so that the data is machine searchable. But, unlike HTML tags, XBRL tags can be used to identify both numerical and textual information. HTML tags, on the other hand, are fairly broad, simplistic, and emphasize only document display (Hoffman et al. 1999). Unlike HTML tags, each XBRL tag provides a wide range of information about the data, including definition, descriptive label, time period, unit of measurement, and mathematical relationships between different elements. As a result, XBRL is a more robust taxonomy that is better suited for analysis of the vast financial and non-financial disclosures required in SEC filings, as well as management discussion and analysis included in annual reports.

THE PUSH FOR XBRL REPORTING IN THE U.S.

A push for mandatory XBRL disclosures began in 2004 when Chairman William H. Donaldson announced that the SEC was actively evaluating the benefits of interactive financial data for official SEC filings. The SEC also encouraged issuers to voluntarily submit supplemental information using XBRL (SEC, 2005). Then, in February 2005, the SEC initiated the XBRL Voluntary Filing Program (VFP) (SEC, 2005). The VFP's explicit purpose was to allow registrants, the SEC, and others to test and evaluate the XBRL tagging technology. In 2006, the SEC contracted with XBRL US to complete the *U.S. GAAP Taxonomies 1.0* (XBRL US, Inc., 2008a) and a *Preparers Guide* (XBRL US, Inc., 2008b), both of which were completed in 2008.

Notwithstanding the early errors and omissions contained in several of the VFP filings (Boritz and No 2005, 2008), and based on a wide spectrum of feedback received from participants and observers of the VFP, the SEC's Advisory Committee on Improvements to

Financial Reporting (ACIFR) recommended that the SEC mandate the filing of XBRL-tagged financial statements for all registrants. Accordingly, in early 2009, the SEC adopted a phase-in procedure to require XBRL disclosures. The final ruling, *Interactive Data to Improve Financial Reporting* (SEC, 2009), requires issuers that use U.S. GAAP or International Financial Reporting Standards (IFRS) to make most SEC filings in XBRL along with their HTML filings. The rules took effect for filings dated on or after June 15, 2009 for approximately 500 accelerated filers (i.e., issuers with a public float over \$5 billion), with phase-in rules for all non-accelerated filers for fiscal periods ending on or after June 15, 2011. In the initial year of filing, filers were only required to tag every financial statement concept in the basic financial statements and tag the footnotes and schedules as blocks of text. In subsequent years, issuers must individually tag all financial statement concepts in all statements, footnotes and schedules. In addition, along with their SEC filings, issuers are also required to simultaneously post their XBRL documents on their corporate websites.

Debreceeny et al. (2010) and Yoon et al. (2011) note that XBRL has quickly become the preferred disclosure format not only in the U.S. but around the world. The general perception is that XBRL is more user-friendly and will enhance the quality and availability of corporate information. The increased quality and availability of information will then lead to more efficient and wide-spread use of the information, resulting in reduced information asymmetry in equity markets (SEC, 2009).

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Research On XBRL

The extant research examining XBRL has been largely descriptive accounts of the nature and background of XBRL, the status of the development of XBRL tags, definitions and terminology, systems implementation issues, or summaries of tagging accuracy and the need for assurances on the resultant documents (Boritz and No, 2005; Debreceeny et al. 2005; Stantial, 2007; Plumlee and Plumlee, 2008; Debreceeny et al. 2011). For example, discussions like that of Debreceeny and Gray (2001) argue for standardized disclosure formats to improve information capture, location and retrieval; while other commentators, like Bartley et al. (2010) argue for a precise nomenclature in developing the tagging taxonomy. Other authors have investigated the accuracy of XBRL produced documents compared to the filers' non-XBRL SEC filings. For example, Bovee et al. (2001) compares results from a commercially packaged XBRL taxonomy program to issuers' filings and find that XBRL reports are 90 to 95 percent accurate. Their results provide evidence on the usability and accuracy of XBRL tags and software. Further, Boritz and No (2008) find that the majority of companies released generally accurate XBRL disclosures; however, they also note that a substantial number of companies initially released XBRL disclosures with various coding errors. Similar results are reported by Bartley et al. (2011) who examined 22 early adopters in their initial 2006 XBRL filing year and then again in 2008. They find that all 22 firms exhibited a substantial number of coding errors in 2006, but by 2008 the frequency and severity of the coding errors in XBRL were significantly reduced.

These findings have caused some XBRL commentators to call for more external assurances on the accuracy of XBRL disclosures (Hunton et al. 2003; Murthy and Groomer, 2004; Boritz and No, 2008; Plumlee and Plumlee, 2008; Pinsker and Wheeler, 2009). Thus, if the quality of XBRL information is inaccurate, inadequate or insufficient, XBRL may not reduce information asymmetry as intended (Neely and Cook, 2011). So, if XBRL filings have poor

quality the XBRL filings could prevent investors' and analysts' from being able to exploit the improvements that are intended to be gained from XBRL technology (Redman, 1998; Strong et al. 1997).

In addition, Premuroso and Bhattacharya (2008) investigated twenty VFP issuers and find that these firms were larger and had higher Institutional Shareholder Services (ISS) governance rankings than a matched sample of non-XBRL filers. However, Callaghan and Nehmer (2009) found that the VFP issuers had lower governance scores than their matched firms, leading them to conclude that early adopters may file XBRL reports to give investors the impression that they are transparent and less-risky investments. These conflicting results provide no clear indication of whether early XBRL adopters in the U.S. used this new technology as a way to improve information transparency and asymmetry for their firm or as a false signal of strong corporate responsibility.

In order to begin an assessment of the impact of XBRL on the capital markets, Yoon et al. (2011) examine bid-ask spreads before and after XBRL implementation in the Korean Stock Exchange. Korea, unlike the U.S., required all firms to file XBRL documents beginning on one date - October 1, 2007, whereas in the U.S., smaller firms are still phasing in XBRL. Additionally, the equity market in Korea does not have designated market makers (Yoon et al. 2011). So, in Korea, most equity transactions are executed directly between sellers and buyers. Whereas in the U.S., most equity transactions involve an intermediary where sellers sell their equities to the intermediary and the intermediary then sell the equities to a buyer. Yoon et al. (2012) find that XBRL formatted information reduced bid-ask spreads, and that the reduction was more pronounced in the largest firms. Accordingly, they find some support for an XBRL reporting effect in the Korean stock market.

The findings on the effects of XBRL in the U.S. are mixed. For example, Kim et al. (2012) investigate the effect of XBRL on firms' event returns volatility, information efficiency, and the standard deviation of daily stock returns around 10-Q and 10-K filing dates. Their results suggest that XBRL decrease event return volatility when there is uncertainty. They also find that XBRL increase information efficiency and reduce the standard deviation of daily stock returns around filing dates. In summary, the findings by Kim et al. (2012) suggest that XBRL reduce information asymmetry in the U.S. The results reported by Blankespoor et al. (2012), however, suggest that XBRL increases information asymmetry as a result of their investigation of the effects of XBRL in the U.S. on bid-ask spread, liquidity, and trading volume. Their results suggest that XBRL increase bid-ask spreads, decrease liquidity, and decrease trading volume in the U.S. Their conclusions are based on comparisons of XBRL filers to non-XBRL filers during the initial phase-in period of XBRL. Kim et al. (2012) and Blankespoor et al. (2012), however, do not emphasize firm-size in their investigations of XBRL. An investigation on XBRL that also emphasize firm-size may clarify whether XBRL reduces information asymmetry in the U.S.

Other studies on the effects of XBRL in the U.S. focus on analysts' behavior during the XBRL era. For example, Ly (2012) explains that XBRL increases information asymmetry because it eases the cognitive burden placed on analysts. Ly's results suggest that analysts' processing of the machine-readable XBRL filings enable analysts' to cover more filings and to process those filings more accurately. Lui et al. (2012) describe firm-size as a control variable that explains an increase in the number of analysts following during the post-XBRL adoption era. In addition to increasing analyst following, Lui et al. (2012) also report results that are consistent with Ly (2012) in that firm-size also improved the accuracy of analysts' forecast during the post-XBRL adoption era. Ly (2012) and Lui et al. (2012) do not proclaim that they are

investigating information asymmetry. Their studies emphasize the impact of XBRL on the quantity and accuracy of analysts forecasts.

Corporate Disclosure, Asymmetry and XBRL

Unbiased and readily available information regarding issuers' performance, governance and future prospects are fundamental to capital market efficiency (Healy et al. 1995; Shaw, 2003; Brown and Fernando, 2011). Security markets function more efficiently when corporate disclosures (including financial statements, footnotes, management discussion, analysis and forecasts) are equally available and analyzable for all interested market participants. The free flow of meaningful and useful information among market participants reduces information asymmetry and results in more informed decisions and enhanced decision confidence and accuracy (Bartov and Bodnar, 1996; Aboody and Lev, 2000).

In a study of how investors search for and use information, Hodge et al. (2004) manipulated the presentation of financial information as a way to examine whether investors prefer searchable versus non-searchable data formats. Their searchable data format was used as a proxy for search-facilitating technology, such as XBRL, and they find that the subjects who used the search-facilitating technology acquired more information than those who did not use the search-facilitating technology. Their results suggest that the use of searchable data, such as XBRL, could improve the quality of disclosures. They note that although the information in the footnotes of disclosures is important, novice investors have a difficult time thoroughly analyzing the data due to their lack of experience, the positioning of the data, and the density of information in the financial statements. XBRL-enabled searching technology reduces this problem for stakeholders. As a result of XBRL, less sophisticated investors, such as retail investors, can more quickly and efficiently analyze large amounts of data and may be able to make informed investment decisions that are similar to the investment decisions made by more sophisticated investors and analysts.

XBRL-tagged disclosures enable all types of users to perform enhanced searches of financial and non-financial data and to more easily compare both within and across filers (Debreceeny et al. 2005). Thus, using XBRL-tagged information may allow market participants to better assess risks associated with the filers and allow stakeholders to better align corporate performance with equity prices. Accordingly, if the overall quality of financial disclosure is significantly improved by XBRL, information asymmetries in the market should be reduced (Graham et al. 2005; Healy and Palepu, 2001; Lambert et al. 2006).

However, as noted in section above, the mixed results from earlier studies regarding the level of financial transparency related to earlier adopters of XBRL raises concerns as to whether XBRL disclosures will increase corporate transparency and significantly affect market behavior. In fact, while many tout the benefits of XBRL, it is not without detractors. For example, Locke and Lowe (2007) question the actual benefits of XBRL and pose the question of whether XBRL is a source of enlightenment or disillusion? So, whether the use of XBRL has actually improved or obscured the quality of information in the U.S., particularly for early adopters, is an unresolved empirical question. Accordingly, we answer calls for further research in this area from Plumlee and Plumlee (2008) and Bartley et al. (2011) and extend prior results on the U.S. market effects associated with XBRL reporting.

HYPOTHESES

The SEC (2005, 2009) has touted XBRL as a mechanism that will generate detailed and accurate data that enhances information search capabilities for all investors, which should reduce asymmetry in the U.S. capital market. XBRL is intended to improve the quality and usefulness of information disseminated to all interested parties rather than increasing the quantity of information (Debreceeny et al. 2011). As noted above, increased information transparency that also enhance analysis capabilities are, in turn, also believed to reduce overall information asymmetry in the capital markets (McNichols and Manegold, 1983; Ajinka et al. 1991; Greenstein and Sami, 1994; Hagerman and Healy, 1992; Healy and Palepu, 2001; Heflin et al. 2005; Kulkarni, 2000), leading to our first hypothesis:

H₁: XBRL reduce bid-ask spreads and increase trading volume in the U.S. capital market.

The SEC mandated the three-year XBRL phase-in of XBRL filings for large firms starting on filings after June 15, 2009. Other issuers began their three-year XBRL phase-in starting on filings after June 15, 2011 and have until 2014 to complete their full XBRL adoption. Yoon et al. (2011) argued that this step-wise approach taken by the SEC implies that the costs and benefits of adopting XBRL may be related to firm size. They argue that the benefits of XBRL reporting to the market may be greater for large companies than for small companies; and that costs may be disproportionately greater for small companies compared to large companies (Diamond and Verrecchia, 1991). However, prior research regarding the presence of information asymmetry and its relation to firm size in the U.S. has typically concluded that information asymmetry is a more prevalent issue with smaller firms than with larger firms (Leuz and Verrecchia, 2000; Healy and Palepu, 2001; Easley et al. 2002). Smaller firms in the U.S. are generally not as closely followed by analysts and institutional investors as are larger public firms. Thus, firm-size may contribute to greater differences in information availability, use and analysis among investment analysts of smaller public companies versus larger public companies (Lambert et al. 2007). Accordingly, improvements in information quality and analyzability through the use of XBRL in the U.S. would generally be expected to be a greater benefit to smaller firms in comparison to larger firms.

However, in their assessment of the impact of XBRL on only the bid-ask spread in the Korean market, Yoon et al. (2011) find a reduction in bid-ask spreads after XBRL adoption for large firms. We might expect the benefits of XBRL adoption in the U.S. to be similar to the findings in Yoon et al. (2011) for the Korean market and also be greater for large U.S. public companies than for small public companies. However, the XBRL firm-size effect on bid-ask spreads along with trading volume in the U.S. for early adopters pre-XBRL and post-xbrl to date has been an unresolved empirical issue. Accordingly, in this study we examine whether the reduction in information asymmetry is consistent across different sized VFP filers, this leading to our second hypothesis:

H₂: The effect of XBRL adoption on reducing information asymmetry is stronger for large U.S. filers than for small U.S. filers.

METHOD

Asymmetry Measures

We test our hypotheses that XBRL-formatted filings reduce information asymmetry by examining two widely used proxies for information asymmetry (Bartov and Bodnar, 1996). Specifically, we examine whether the bid-ask spreads and trading volume on the day of the earnings announcement are significantly different when firms release XBRL-formatted documents compared to their earnings announcements using non-XBRL-formatted filings. Bid-ask spreads are the difference between what buyers are willing to pay for a given security and what holders of that security are asking for in a contemplated sale. Bid-ask spreads are a measure of information asymmetry in that if all parties are fully and equally informed, theoretically there would be no difference between what sellers are willing to accept and what buyers are willing to pay, resulting in a bid-ask spread of zero (Bartov and Bodnar, 1996; Leuz and Verrecchia, 2000). Therefore, larger bid-ask spreads would indicate higher information asymmetry in the market. Accordingly, we follow prior researchers (Kane and Velury, 2004; Lee and YiLin, 2009; Yoon et al. 2011; Brown and Fernando, 2011; Blankespoor et al. 2012) and assess bid-ask spread as a proxy for information asymmetry, and the reduction in bid-ask spreads as evidence of a reduction in information asymmetry.

Trading volume is an indication of the willingness of market participants to exchange securities. Prior research has demonstrated that investors reduce their investing activity when they are less uninformed (Bartov and Bodnar, 1996). XBRL, however, is thought to increase investing activity by better informing investors with ready-to-use digital disclosures (AAA, 2004). Therefore, if information asymmetry decreases, parties to the exchange are more willing to engage in a transaction, causing trading volume to increase (Brown and Fernando, 2011). Accordingly, we would expect trading volume to be higher under reduced information asymmetry. We follow prior researchers (Bamber, 1986; Ajinka et al. 1991; Bodtov and Bodnar, 1996; Lee and YiLin, 2009; Brown and Fernando, 2011; Blankespoor et al. 2012) and examine trading volume as our second proxy for information asymmetry. If information asymmetry is reduced, we would expect to find an increase in trading volume. Therefore, we test for reduced information asymmetry in the U. S. market following implementation of XBRL by assessing firms' reductions in bid-ask spread and increases in trading volume.

Following prior research, we compute the bid-ask spread (*SPREAD*) and trading volume (*TVOLUME*) follows:

$$SPREAD_{it} = (Ask_{it} - Bid_{it}) / [(Ask_{it} + Bid_{it}) / 2] \quad (1)$$

$$TVOLUME_{it} = Daily\ Shares\ Traded_{it} / Total\ Shares\ Outstanding_{it} \quad (2)$$

Where Ask_{it} is the ask price of stock i on day t , and Bid_{it} is the bid price of stock i on day t ; and $Daily\ Shares\ Traded_{it}$ is the volume of stock i shares traded on day t , and $Total\ Shares\ Outstanding_{it}$ is the number of stock i shares outstanding on day t . Our measures of asymmetry are calculated on the day of the earnings announcement for periods prior to adoption of XBRL filings and immediate periods following XBRL adoption.

Sample identification

We began our sample selection procedures by identifying all quarterly earnings announcements accompanied with XBRL-formatted financial information filed with Form 10-q

or Form 10-k with the SEC during their Voluntary Filing Program (VFP) that began in 2005. For each firm identified as filing XBRL-formatted financial statements, we use their initial quarterly XBRL filing to indicate the start of their post-XBRL reporting period. We then create a balanced sample, by firm, by starting with their XBRL adoption date and working back in time until we include the same number of quarterly observations in the firm's pre-XBRL reporting period as were included in their post-XBRL reporting period. We deleted observations where the earnings announcement date was not the same day as the availability of the XBRL-formatted filings on EDGAR. Using this procedure we were able to identify 82 VFP filing firms which have all necessary information that made a total of 366 quarterly announcements/filings using XBRL (i.e., in the post-XBRL period) and a matching sample of 366 observations in the firm's pre-XBRL reporting period for a total of 732 firm-quarter observations. Table 1 presents the distribution of the 732 quarterly observations by year.

Table 1
Sample Distribution

Distribution of sample quarterly observations from 2001 to 2010.

Year	Pre-XBRL	Post-XBRL	Total
2001	4	0	4
2002	4	0	4
2003	4	0	4
2004	4	0	4
2005	6	2	8
2006	5	5	10
2007	27	9	36
2008	162	17	179
2009	148	178	326
2010	2	155	157
Total	366	366	732

In order to test our second hypothesis related to firm size, we partition our sample based on market value of equity (*MVE*) at the time of their initial XBRL filing and create three firm-size groups: large firms (i.e., the largest third), medium size firms (i.e., the middle third), and small firms (i.e., the smallest third).

Analysis methods

In order to examine the effect of XBRL-formatted SEC filings on information asymmetry, we first employ a paired-sample *t*-test to examine differences in pre- and post-XBRL

filings for the firms in our study. However, in order to control for other related factors, we also employ a multiple regression analysis to provide a more robust assessment of any XBRL effects on our measures of information asymmetry. Accordingly, for the assessment of bid-ask spreads we estimate the parameters in the following multiple regression model:

$$SPREAD_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 MVE_{it} + \beta_3 TVOLUME_{it} + \beta_4 VOLATILITY_{it} + \beta_5 STOCKPRICE_{it} + e_{it} \quad (3)$$

Our dependent variable in the regression model is *SPREAD*, the bid-ask spread on the day of each earnings announcement. The XBRL reporting period identifier (*XBRL*) variable is the explanatory variable of interest in the model. XBRL adoption was treated as a categorical variable and the firm's pre-XBRL adoption period was coded as 0 and the post-XBRL adoption period was coded as 1. In order to more accurately assess changes across individual firms, we use a firm fixed-effects model which essentially treats each firm as its own control in the assessment of changes.

Our model also controls for firm size because prior research has indicated that size is associated with information asymmetry. Previous research has found that information asymmetry is negatively associated with firm size (Easley et al. 2002; Greenstein and Sami, 1994; Hasbrouck, 1991; Leuz and Verrecchia, 2000). Large firms tend to have lower information asymmetry because they have a larger following in the equity market (i.e., they receive more attention from media and investment analysts than smaller firms). Accordingly, we include the market value of equity (*MVE*) as our measure of firm size.

Bamber (1986) and Brown and Fernando (2011) document a negative relationship between trading volume and information asymmetry. Accordingly, we include our measure of trading volume (*TVOLUME*) as an additional control in our bid-ask analysis. Volatility of price also influences bid-ask spread. Kanagaretnam et al. (2007) find that under higher volatility, market makers increased the spread to compensate for higher risk and uncertainty in the market. Kim et al. (2012) find that XBRL decreases volatility. Therefore we include a control for volatility (*VOLATILITY*) in our bid-ask model. While the conclusions from prior research are mixed, it would seem that stock price level would also have an impact on bid-ask spread. Given that a 1 cent price increment would have twice the impact on the bid-ask spread for a \$5 stock compared to a \$10 one, we include the average daily price (*STOCKPRICE*) as an additional control.

For our second proxy of information asymmetry, trading volume, we estimate the parameters in the following multiple regression model:

$$TVOLUME_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 MVE_{it} + \beta_3 VOLATILITY_{it} + \beta_4 ABSRETO_{it} + e_{it} \quad (4)$$

Following Ajinka et al. (1991), our dependent variable is *TVOLUME*, the firm's daily share volume divided by total number of shares outstanding on the day of the earnings announcement. Again our explanatory variable of interest is the XBRL reporting period identifier (*XBRL*) in the regression model. As in the bid-ask spread analyses, we again use a firm fixed-effects model in order to more appropriately isolate *TVOLUME* changes for each firm after the adoption of XBRL.

Similar to our bid-ask regression model, we include *MVE*, *VOLATILITY* as controls for size and price volatility, factors shown to be related to trading volume. An additional control,

the absolute value of the daily return on the earnings announcement date (*ABSRETO*) is included in this model as we expect that earnings announcements containing the most recent information (as reflected in price changes for the day) to have a significant overall impact on the market. New information would likely be positively related with trading volume (Bamber, 1986). Therefore, as a control for new information to the market we include a measure for the absolute value of the daily return.

FINDINGS

Univariate Results

Table 2 presents the results of the univariate paired-sample *t*-tests for the pre- versus post-XBRL reporting periods. For the *SPREAD* variable we find significantly ($p < .01$) smaller bid-ask spreads in the post-XBRL period compared to the pre-XBRL period. However, we find no significant difference between the pre- and post-XBRL periods for *TVOLUME*, our measure of the firm's stock traded on the announcement date. Further, untabulated results of *t*-test comparisons for the three sub-samples based on firm size are identical to the results presented in Table 2 for the overall sample. Thus, our univariate results lend partial support to our first hypothesis, but not our second hypothesis. However, a more robust multivariate examination that controls for additional factors is needed to provide a more appropriate assessment of any significant XBRL effect. Results of these tests are provided in Table 2.

Table 2
Univariate Results

Univariate results for all variables: pre-XBRL sample vs. post-XBRL sample. Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Variable	Pre-XBRL (n= 366)	Post-XBRL (n= 366)	Difference	t-stat	
SPREAD	0.0016	0.0008	-0.0008	6.032	***
MVE	26.31	28.63	2.3220	0.707	
TVOLUME	0.0318	0.0311	-0.0007	0.219	
VOLATILITY	0.0786	0.0552	-0.0234	7.015	***
PRICE	39.67	39.88	0.2029	0.085	
ABSRETO	0.0561	0.0400	-0.0161	4.746	***

Note: Variables are defined as: SPREAD is $(\text{ask price} - \text{bid price}) / ((\text{ask price} + \text{bid price}) / 2)$ on day of announcement, MVE is market value of equity on June 30th prior to the earnings announcement, TVOLUME is daily share volume/total shares outstanding, VOLATILITY is $(\text{ask high price} - \text{bid low price}) / ((\text{ask high price} + \text{bid low price}) / 2)$ on day of announcement, PRICE is share price on day of announcement, ABSRETO is absolute value of total return on stock on day of announcement.

Multivariate Results

Pearson correlations coefficients for *Post-XBRL*, *SPREAD*, *TVOLUME*, *MVE*, *VOLATILITY*, *PRICE*, and *ABSRETO* are presented in Table 3. Table 3 reveals that there are relatively low correlations between post-XBRL and the other dependent variables for the firms in the study. In addition, variance inflation factors (VIF) for all of the variables across all of

regression models performed in the study were below 2.0, well below the typical 10.0 used to identify multicollinearity.

Table 3
Sample Correlations

Correlations among variables. Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Variable	1	2	3	4	5	6
1 Post-XBRL						
2 SPREAD	-0.21 ***					
3 MVE	0.03	-0.09 ***				
4 TVOLUME	-0.01	0.04	-0.20 ***			
5 VOLATILITY	-0.25 ***	0.32 ***	-0.26 ***	0.31 ***		
6 PRICE	0.00	-0.09 ***	0.20 ***	-0.04	-0.19 ***	
7 ABSRETO	-0.17 ***	0.25 ***	-0.18 ***	0.42 ***	0.54 ***	-0.13 ***

Note: Variables are defined as: Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, SPREAD is $(\text{ask price} - \text{bid price}) / ((\text{ask price} + \text{bid price}) / 2)$ on day of announcement, MVE is market value of equity on June 30th prior to the earnings announcement, TVOLUME is daily share volume/total shares outstanding on day of announcement, VOLATILITY is $(\text{ask high price} - \text{bid low price}) / ((\text{ask high price} + \text{bid low price}) / 2)$ on day of announcement, PRICE is share price on day of announcement, ABSRETO is absolute value of total return on stock on day of announcement.

Bid-Ask Spread

In order to test our two hypotheses, we first assess bid-ask spread and estimate the coefficients for the multivariate regression model in Eq. (3) and present the results in Table 4. Model I examines our full sample of 732 observations, and Models II, III, and IV present the regression results when analyzing the smallest third, middle third and largest third, respectively, of our sample firms based on size (as measured by *MVE*). As depicted in the first column for Model I, the coefficient on *Post-XBRL* is negative and significant, indicating that, overall, firm bid-ask spreads are significantly smaller in the post-XBRL period compared to the pre-XBRL period, even after controlling for other factors associated with bid-ask spreads. In addition, the coefficients for our control variables are all significant (p -values < .05) in this full sample regression. Similar to the univariate analysis, these full-sample results for *SPREAD* support our first hypothesis that XBRL reduces information asymmetry.

Table 4
Multivariate Results - Bid/Ask Spread

Regression models for bid/ask spread (SPREAD). Model I includes total sample, Models II, III, IV include smallest, mid, and largest third of sample split by size (MVE). Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Independent Variable	Model Specification			
	I	II	III	XI
	Total Sample (n=732)	Smallest Third (n=239)	Mid Third (n=253)	Largest Third (n=240)
Post-XBRL	-0.249 ***	-0.219	-0.038	-0.510 ***
MVE	-0.189 ***	-0.187 ***	0.216	-0.101
TVOLUME	-0.222 ***	-0.112	-0.415 ***	-0.115
VOLATILITY	0.584 ***	0.336 **	0.933 ***	0.441 *
PRICE	-0.142 **	-0.172 *	-0.149	-0.148
Constant	-2.908 ***	-2.987 ***	9.470 **	-4.240 *
<i>F-test</i>	26.390 ***	6.750 ***	6.530 ***	4.230 ***
<i>Adjusted R</i>	0.148	0.108	0.099	0.063

Note: Variables are defined as: SPREAD is the log of (ask price - bid price)/((ask price + bid price)/2) on day of announcement, Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, MVE is log of the market value of equity on June 30th prior to the earnings announcement, TVOLUME is the log of daily share volume/total shares outstanding on day of announcement, VOLATILITY is the log of (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, PRICE is the log of share price on day of announcement. Yearly indicator variables for years 2001 to 2010 are included in model but not shown.

However, a different picture emerges when examining the results from Models II, III, and IV in Table 4 when partitioning our sample based on firm size in order to assess our second hypothesis. Similar to the findings of Yoon et al. (2011), we find that our significant *SPREAD* results are located largely only in the largest firms in our study and not in the smaller and midsized U.S. firms that voluntarily adopted XBRL early. In addition, our control variables are found to be significant in one or more of the size sub-sample regressions. Accordingly, we find support for our second hypothesis that XBRL had a greater impact on reducing information asymmetry, as proxied by *SPREAD*, for the largest early XBRL adopting U.S. firms but not for the smaller and midsized early XBRL adopting firms.

Trading volume

Table 5 presents the coefficients for the multivariate regression model in Eq. (4) examining *TVOLUME*. Again, Model I examines our full sample of 732 observations, and Models II, III, and IV present the regression results when analyzing the smallest third, middle third, and largest third of our sample firms, respectively. Our control variables are again found to be significant in one or more of the *TVOLUME* regressions.

Consistent with the *TVOLUME* univariate results, the regression results indicate no statistically significant differences between pre- and post-XBRL and *TVOLUME* for the full sample, and for the smallest and middle third firm-size sub-samples. However, similar to our multivariate *SPREAD* results, we find a significant *TVOLUME* effect for the largest firms in our study. Specifically, for the largest firms, we find that after controlling for other trading volume

related factors, *TVOLUME* is significantly greater in the post-XBRL period versus the pre-XBRL period. Accordingly, we find support for our first hypothesis for the largest VFP filers and for our second hypothesis regarding firm-size effects with respect to the benefits of XBRL reporting in the U.S.

Table 5
Multivariate Results - Trading Volume

Regression models for trading volume (*TVOLUME*). Model I includes total sample, Models II, III, IV include smallest, mid, and largest third of sample split by size (*MVE*). Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Independent Variable	Model Specification			
	I	II	III	IV
	Total Sample (n=732)	Smallest Third (n=239)	Mid Third (n=253)	Largest Third (n=240)
Post-XBRL	0.069	0.032	0.044	0.187 **
<i>MVE</i>	-0.176 ***	0.035	-0.267 **	-0.175 ***
<i>VOLATILITY</i>	0.167 *	0.197	0.026	0.395 **
<i>ABSRETO</i>	0.285 ***	0.331 ***	0.275 ***	0.250 ***
Constant	-2.670	-7.047	1.257	-8.467 **
<i>F-test</i>	37.830 ***	7.020 ***	8.810 ***	16.730 ***
<i>Adjusted R</i>	0.396	0.232	0.287	0.372

Note: Variables are defined as: *TVOLUME* is the log of daily share volume/total shares outstanding on day of announcement, Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, *MVE* is log of the market value of equity on June 30th prior to the earnings announcement, *VOLATILITY* is the log of (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, *ABSRETO* is the log of the absolute value of total return on stock on day of announcement. Yearly indicator variables for years 2001 to 2010 are included in model but not shown.

Overall, our results provide some support for the conjecture that XBRL reduces information asymmetry (hypothesis H_1) and strong support that the effect of XBRL is greater for larger companies (hypothesis H_2). While we find significant reductions in bid-ask spreads after adopting XBRL for our entire sample in the *SPREAD* regression analysis, providing some support for H_1 , we do not find significant increases in trading volume after XBRL adoption in the *TVOLUME* analyses for our entire sample. Increases in trading volume after XBRL adoption are found only for the partition of largest firms in our study. However, we find strong support for a firm-size effect in H_2 for both our *SPREAD* and *TVOLUME* analyses. In both of these analyses we find evidence that the largest firms in our study exhibit significant reductions in information asymmetry (i.e., reductions in bid-ask spreads and increases in trading volume) following the release of information using XBRL.

DISCUSSION AND CONCLUSION

The SEC posits that XBRL enhances transparency and reduces information asymmetry. In this paper we examine whether XBRL reduces information asymmetry in the U.S. equity

market. We investigate two proxies for information asymmetry: bid-ask spread (*SPREAD*) and trading volume (*TVOLUME*). Our results suggest that bid-ask spread reductions and trading volume increases are most pronounced for large early XBRL adopters. Meanwhile, only bid-ask spread reductions are significant for all early XBRL adopters regardless of size. While somewhat mixed, our results generally provide support for the contention that XBRL formatted filings will help reduce information asymmetry in the U.S. equity market, particularly for large SEC filers.

A possible reason for our mixed, yet positive results could be the quality of the early XBRL filings examined in the study (Bartley et al. 2011; Bovee et al. 2002). Based on possibly lower initial information quality in early XBRL filings, potential users of the XBRL information may have been wary of full reliance on early XBRL filings, particularly from small early adopters. Moreover, more sophisticated analysts and investors may be more likely to analyze larger filers and pay less attention to smaller filers. Thereby, we would expect to observe reductions in information asymmetry for large filers, but not necessarily for small and medium filers who are not as closely examined by analysts and institutional investors. Our results are not in opposition to this conjecture. We say this because XBRL does not provide more information for any filer (small, medium, or large) in our sample. There is more readily available information beyond that of SEC filings for large filers versus small and medium filers. The case may be that investors and analysts use XBRL to reduce their data gathering efforts and preparation time while confirming information about large filers that they were already aware of prior to the SEC filing. In contrast, for small and mid-sized filers, there may be little or no readily available information to be confirmed with an XBRL filing. Our study is limited in that we do not observe investors' use of XBRL but we do presume that investors use XBRL because of its enhanced information processing capabilities (Hodge et al. 2004) and reliability (SEC, 2009, 92). To date, it is not clear whether there is variation in the way that XBRL is used by each user type (i.e., institutional investor versus retail investor). We leave this issue for future research.

We include only early XBRL adopters in the SEC's VFP for analysis. We limit our study to this sample of early XBRL adopters so that we can control for XBRL filing experience. We aggregate this sample of firms and examine them pre- versus post-XBRL to control for firm characteristics such as transparency differences, thought leadership, and technological leadership. Our analysis is informative for initial market reactions and possible implications of XBRL information for early adopters, as well as providing a clean test of pre- and post-XBRL market effects. However, this study does not address the effect of XBRL reporting on information asymmetry for the entire U.S. market or for an extended period of time. Future research is needed once XBRL has enjoyed wide-spread use in the U.S. to examine these additional issues of market information asymmetry as we approach the full adoption of XBRL for all filers in year 2014. In addition, future research should examine other measures of information asymmetry in order to provide a more robust evaluation of XBRL reporting effects and its intended benefit to the U.S. equity market. Furthermore, the need for assurances on the quality and accuracy of XBRL filings, particularly in the move toward continuous auditing of financial information, may receive heightened attention as more filers use XBRL, and may present additional avenues for future research (Debreceeny et al. 2010).

Limitations notwithstanding, this paper extends our understanding of the impact of initial XBRL filings on information asymmetry in the U.S. equity market, and should be of interest to market regulators, observers and market participants. In sum, we find a correlation between reduced information asymmetry in the U.S. market during the post-XBRL versus the pre-XBRL era for a sample of early XBRL adopting firms, and this conclusion is particularly true for large

filers. To the extent that our findings on early adopters reflect the ongoing market-wide effects of XBRL, our findings generally support the use of XBRL for SEC filings of corporate financial and non-financial information to equity markets.

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