Received 24 November 2012
Revised 5 February 2013
11 March 2013
29 March 2013
Accepted 29 March 2013

Does voluntary adoption of XBRL reduce cost of equity capital?

Lizhong Hao
California State University, Fresno, California, USA
Joseph H. Zhang
School of Accountancy, The University of Memphis, Memphis, Tennessee, USA, and
Jing (Bob) Fang
The Beacom School of Business, University of South Dakota, Vermillion, South Dakota, USA

Abstract

Purpose – The paper aims to examine whether or not firms voluntarily filing in XBRL (eXtensible Business Reporting Language) format enjoy a lower cost of capital. XBRL, or "interactive data" as the US Securities and Exchange Commission refers to it, is an information format that enables electronic exchange of standardized business and financial information.

Design/methodology/approach – The authors investigate whether voluntary adoption of XBRL impacts cost of equity capital using a sample of US firms participated in the SEC Voluntary Filer Program, each matched with a pair of non-XBRL filers (matched by two-digit SIC code, same fiscal yearend, and close total assets in the same year). The authors measure firm-specific cost of equity capital at the fiscal year of last voluntary XBRL filing, using the PEG ratio model proposed by Easton, Gode and Mohanram, and Hou *et al.*

Findings – The results show that cost of equity capital is significantly and negatively associated with XBRL adoption. The magnitude of the coefficient on XBRL suggests that firms voluntarily adopting XBRL are associated with an average reduction in cost of equity capital by 17-20 basis points (conditional on different cost of capital measures).

Research limitations/implications – There is a research limitation due to the sample of voluntary XBRL adopters as of self-selection bias. The authors address this issue by using the Heckman two-stage regression procedure.

Practical implications – The study provides evidence on the economic consequence of XBRL adoption in that it benefits shareholders by reducing the cost of equity capital. The evidence should provide regulators like the SEC more incentives to mandate the XBRL standard and motivate companies to adopt the standard as well.

Originality/value – By showing that voluntary XBRL adopters are associated with lower cost of equity capital, the study provides timely and relevant empirical evidence to the economic consequences of voluntary adoption of XBRL. It also contributes to the limited empirical research on the economic consequences of new information technology and highlights the importance of institutional regulation in shaping the outcomes of new financial reporting format.

Keywords Information systems, Cost of equity capital, US evidence, XBRL

Paper type Research paper

International Journal of Accounting and Information Management
Vol. 22 No. 2, 2014
pp. 86-102

1834-7649
DOI 10.1108/IJAIM-11-2012-0071

1. Introduction

The paper examines whether firms voluntarily filing in eXtensible Business Reporting Language (XBRL) format enjoy a lower cost of equity capital (CofE). XBRL, or "interactive data" as the Securities and Exchange Commission (SEC) refers to it, is an

information format that enables electronic exchange of standardized business and financial information. XBRL specifications were developed by XBRL International, a non-profit consortium of approximately 550 companies, governments, stock exchanges, and accounting organizations around the world working together to build XBRL language and promote its global adoption[1].

In USA, the primary driver for XBRL filing comes from the SEC. Since early 2004, the SEC has proposed the rule (No. 33-8496) to establish a voluntary program and encourage registrants to use XBRL. In the rule No. 33-8529 regarding the Voluntary Filer Program (VFP), the SEC asserts that XBRL benefits all users of financial information by means of improving information transparency and lower CofE (SEC, 2005). While prior research finds some evidence that XBRL improves transparency of financial reporting (Hodge *et al.*, 2004; Tan and Shon, 2009), there is little empirical research to date supporting the SEC's assertion that XBRL interactive data reduces CofE and the economic consequence of such adoption still remain unclear. Thus, we aim to explore the impact of XBRL adoption on the CofE for US companies who participate in the VFP.

There are at least three reasons why voluntary adopting XBRL may reduce CofE. First, XBRL may reduce capital cost through "improved information transparency". As an interactive data format, XBRL has the potential to improve comparability and consistency of information, enhances accessibility and usability to financial and nonfinancial information, and increase financial disclosure. Second, XBRL may "reduce transaction cost". Implementing XBRL may incur additional costs at the beginning of such adoption. In the long run, however, XBRL will lower the cost of producing information through automation and free resources from manual work (SEC, 2005). Third, adopting XBRL may "increase liquidity" and "decrease firm risk". Proponents of XBRL argue that since XBRL-tagged data are more transparent, they should reduce the uncertainty and risk of investors. Moreover, filing in XBRL interactive data may lead to "broader analyst coverage", more market exposure and greater investor interest and confidence in a registrant's securities (SEC, 2005). Therefore, XBRL could lower firm risk and increase market liquidity, and eventually lower the CofE.

We investigate whether voluntary adoption of XBRL impacts CofE using a sample of firms participated in the SEC VFP, each matched with a pair of non-XBRL filers (matched by two-digit SIC code, same fiscal yearend, and close total assets in the same year). We measure firm-specific CofE at the fiscal year of last voluntary XBRL filing, using the PEG ratio (Easton, 2004). We then regress firm-specific CofE on a dummy variable indicating the type of firms (one for XBRL filers and zero otherwise) and a set of control variables that include firm size and risk. We predict that a firm's CofE is negatively associated with XBRL adoption.

Multivariate regression results indicate that CofE is negatively and significantly associated with XBRL filings after controlling for firm size and risk. The magnitude of the effect is such that, on average, XBRL adoption is associated with a reduction in the CofE of 1.7 percent points for the sample firms. The primary results persist when we use alternative CofE measures and apply with different model specifications.

This study contributes to the literature in the following ways. First, it provides timely and relevant empirical evidence to the economic consequences of "voluntary adoption of XBRL". XBRL is a new revolution in financial reporting and it will dramatically change the reporting process. However, there is little empirical research on the capital market effects of XBRL adoption. This study provides evidence that

such adoption benefits shareholders by reducing the CofE. The evidence should provide regulators like the SEC more incentives to mandate the XBRL standard and motivate companies to adopt the standard as well.

Second, we contribute on the economic consequences of "new accounting information technology". By facilitating comparability across companies, XBRL makes financial reporting more transparent; hence help them make more informed decisions (Han and McKelvey, 2008). Despite the extensive development and application of information technology in the business world, there is little evidence on the costs and benefits of information technology. This study examines voluntary adoption of interactive data and provides evidence on important questions of whether new information technology can play a useful role in improving financial reporting.

Third, findings in this study highlight the "importance of institutional regulation" in shaping the outcomes of new financial reporting format. Critics of XBRL have been challenging the extra cost of implementing XBRL, its reliability and credibility issues. However, under the leadership of XBRL International, companies, governments, stock exchanges, and accounting organizations work together to build XBRL standard and promote its adoption. In the USA, in particular, the SEC has been taking active role in proposing the voluntary filings then mandating its adoption. Our findings provide more incentives for regulators around the world to mandate the new filing standard.

Section 2 provides background and review of prior literature related to XBRL. Section 3 develops hypotheses. Section 4 describes research methodology. Section 5 describes sample selection and descriptive statistics. Section 6 reports empirical results, and Section 7 concludes.

2. Background and literature review

This section provides an overview of XBRL and the extant literature on XBRL. Traditionally financial data has been passed around in non-interchangeable formats – HTML, Microsoft Excel, PDF, or plain text files. These static formats do not support electronic data interchange. XBRL is a dynamic format that enables electronic exchange of business information (XBRL.org, 2002). It is an extension of eXtensible Markup Language (XML). XBRL defines each individual element contained in a company's financial statement so that data can be tagged and computer readable. Each element is assigned a unique barcode which contains information regarding the item's definition and various attributes. After financial data are tagged, a company's financial information can be read, understood and manipulated by a computer program, and these data can be transmitted electronically, retrieved and analyzed efficiently by investors within minutes (Tan and Shon, 2009). Each particular element of XBRL tags is associated with an external taxonomy. Taxonomies are essentially data dictionaries of financial concepts, available for all major accounting principles, including the US GAAP. The next step involves using specific software to link the tagged data to specific XBRL taxonomy (Debreceny *et al.*, 2005).

The SEC has made great effort to promote the adoption of the interactive data in the USA. In April 2005, the SEC issued its Final Rule No. 33-8529 for the VFP that encouraged registrants to voluntarily file certain mandated financial information using XBRL format (SEC, 2005). In December 2008, the SEC passed Final Rule No. 33-9002 that mandate public companies to submit financial statements in XBRL format along with their regular SEC filings (SEC, 2008), with a phase-in schedule over three-year

periods, beginning with requiring large public companies with a market float of $5 billion and above to submit XBRL filings for the first quarterly reports for fiscal periods ending on or after June 15, 2009. The remaining companies filing according to US GAAP will be required to provide XBRL data in the next two years. All public US companies will be filing in XBRL by December 2011.

Prior research on XBRL primarily focuses on characteristics of the new reporting standard, its feasibility, the cost and benefits of using XBRL. For instance, Debreceny *et al.* (2005) critically evaluate the implications and feasibility of the voluntary financial reporting program proposed by the SEC in three aspects: the role of XBRL in financial reporting, the design and management of XBRL taxonomies, and the impact of XBRL on the SEC's filing program. They view XBRL as vital in democratization of markets and conclude with strong support for the SEC initiative for the VFP. Efendi *et al.* (2011) investigate the SEC's VFP and firm characteristics of early filers. They find that voluntary filers are large, innovative, and that the number of XBRL filings has significantly increased since the VFP was started.

Using 20 XBRL filers and a matched sample of non-filers, Premuroso and Bhattacharya (2008) find that early voluntary filers are associated with superior corporate governance and performance. Hodge *et al.* (2004) examine whether the use of XBRL improves information transparency. In an experimental setting they investigate whether XBRL helps nonprofessional investors acquire and integrate financial information. They infer that using XBRL technology helps nonprofessional financial statement users acquire and integrate more relevant financial statement and footnote information when making investment decisions. Pinsker and Li (2008) conduct interviews with four business managers involved in XBRL adoption in four countries including the USA. Their survey results indicate that XBRL makes reporting information more transparent to capital market, and respondents believe that such transparency would reduce the uncertainty and risk of investment and eventually lower CofE.

Meanwhile, the adoption of XBRL filing raises concern of the credibility and reliability of the information contained in XBRL format. Boritz and No (2008) find that most companies participating in the VFP did not include notes and MD&A in their XBRL filings. They also find some instances that the XBRL filings did not match with the relevant paper filings, and many XBRL filings in the VFP contain inconsistencies and errors. Bartley *et al.* (2011) compare XBRL filings to the corresponding Forms 10-K and find numerous errors and inconsistencies including omitted amounts, incorrect signs, inaccurate values, inaccurate labeling and improper classification of financial statement elements. Nevertheless, they find the errors decrease over time, suggesting that the VFP for XBRL becomes successful.

Regarding the credibility of XBRL filings, Plumlee and Plumlee (2008) discuss several important assurance-related issues that must be addressed in a data-centric reporting environment, such as a better definition of what constitutes an "error" and a clearer meaning of materiality. After validating whether company extension taxonomies conform to XBRL specification and examining whether XBRL documents are the same as the most closely related paper filings, Boritz and No (2008) find that quality control and assurance problems exist and have not improved. Srivastava and Kogan (2010) point out that the use of XBRL potentially enables reporting enhancements above and beyond what is currently available in the standard format documents, however, such enhancement would elevate the status

of the XBRL document beyond the simple add-on, and will require assurance going beyond the simple comparison with traditional format filings.

3. Hypothesis development

XBRL is an information format. Information theories indicate that information quality is negatively associated with CofE (Lambert *et al.*, 2007). There are at least two reasons supporting this relationship. First, greater and high quality information disclosure improves information transparency, and then reduces investors' uncertainty and risk about a firm's future performance, which in turn increases demand for a firm's securities and enhance market liquidity. As the result, investors may require a lower rate of return. Second, greater and high quality disclosure reduces information asymmetry between investors and management, thus decreases transaction costs, leading to a lower cost of equity financing (Botosan, 1997; Souissi and Khlif, 2012).

With inferences above, we reason that XBRL adoption is expected to reduce CofE. First, XBRL tagged data has the potential to improve information transparency through "improving comparability" and "consistency". Prior research has found that XBRL improves information comparability, reliability and decision usefulness (Hodge *et al.*, 2004; Baldwin *et al.*, 2006), and enhances the transparency of management's financial reporting choices and disclosure management (Li *et al.*, 2006). Moreover, XBRL supports more "effective communication and delivery" of disclosed information to all users and enhances accessibility and usability to financial and nonfinancial information. Data are entered once and understood consistently and accurately thereafter. Extant research has found that more transparency leads to lower CofE (Barth *et al.*, 2013) and increased quality disclosure reduces cost of equity capital (Botosan, 1997).

Second, XBRL may lower CofE through "reduced transaction costs" for filers and investors as well. It is true that the adoption of XBRL reporting will lead to some additional costs for registrants at the beginning. In the long run, however, XBRL will lower the cost of producing information through automation and free resources from manual work (SEC, 2005), save the cost of re-keying data, and lower cost of bookkeeping. With XBRL data available, an investor can immediately pull out specific information and compare it to information from other companies within seconds[2]. Malhotra and Garritt (2004) find that XBRL will reduce the cost of processing, calculating and formatting financial information because, once the data are created and formatted the first time, they will never need to be keyed in a second time. It is purported that information users can receive, find, compare, and analyze data much more rapidly and efficiently if it is in XBRL format, "cutting out laborious and costly processes of manual re-entry and comparison" (XBRL International, 2002).

Third, adopting XBRL may lead to a reduction of CofE through "reduced firm risk". Proponents of XBRL argue that XBRL tagged data are more transparent, which reduces the uncertainty and risk of investors who provide capital to the company. Moreover, filing in XBRL interactive data may lead to broader analyst coverage, more market exposure and greater investor interest and confidence in a registrant's securities (SEC, 2005). Debreceny *et al.* (2005) predict that, by allowing companies to disseminate information on a timely basis, XBRL may reduce the gap between accounting risk measures and market risk measure. As such, the financial community may perceive lower risks for companies filing in XBRL format due to their higher transparency. Thus, XBRL could lower firm risk and increase liquidity in the market and eventually lower the CofE.

To sum up, the theory and research discussed above lead to our following hypothesis: There is a negative association between XBRL adoption and CofE, and there is a significant reduction of CofE for voluntary XBRL-adopters, relative to non-adopting peer firms.

4. Research methodology

In this section, we describe the measure of CofE and discuss the regression model and independent variables.

Calculating the cost of equity capital

We measure expected CofE implied in current stock prices and analysts' forecasts of future earnings. In our main test, we use the PEG ratio model proposed by Easton (2004). We choose this model not only because it is widely used in prior research (Francis *et al.*, 2008; Barth *et al.*, 2013) and it is one of the two models that are proved to be more reliable based on a comparison with firm risk (Botosan and Plumlee, 2005), but also because it has less data requirements. The model is as follows:

$$CofE_{it} = \sqrt{\frac{EPS_{t+2} - EPS_{t+1}}{P_t}} \quad (1)$$

where:

$CofE_{it}$ = firm's implied cost of equity capital measured at fiscal year t.

EPS_{t+1} = the median analyst forecast of earnings for one year ahead.

EPS_{t+2} = the median analyst forecast of earnings for two year ahead.

P_t = the stock price per share at fiscal year t.

This model provides the expected rather than realized returns by using analysts' earnings forecasts and price in the valuation equation. Considering the effect of voluntary XBRL adoption on CofE may be delayed due to uncertainty of the new standard, we measure *CofE* at the fiscal year when the firm voluntarily filed its last XBRL report. Following Easton (2004), we require EPS_{t+1} and EPS_{t+2} to be positive and $EPS_{t+2} > EPS_{t+1}$ to ensure equation (1) has two real roots.

Empirical model

The empirical model regresses cost of equity capital (*CofE*) on XBRL adoption (*XBRL*), market beta (*BETA*), the natural log of market value (*LMV*), financial leverage (*LEV*), and return on assets (*ROA*). Our model is following with Botosan and Plumlee (2002). In the regression, we also include industry fixed effects based on one-digit SIC classification:

$$CofE_{it} = \beta_0 + \boldsymbol{\beta_1 XBRL_{it}} + \beta_2 LMV_{it} + \beta_3 BETA_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + e_{it} \quad (2)$$

where:

$CofE_{it}$ = implied cost of equity capital.

$XBRL_{it}$ = 1 if firms participated in the SEC VFP and 0 otherwise.

LMV_{it} = the natural logarithm of market value at fiscal yearend.

$BETA_{it}$ = firm-specific annual beta obtained from CRSP Indices database.

LEV_{it} = financial leverage computed as the total liabilities divided by total assets at fiscal yearend.

ROA_{it} = return on assets measured as current year net income before extraordinary items divided by prior year total assets.

Our variable of interest is *XBRL*, an indicator variable that is coded as one when the firm is a voluntary XBRL filer and zero otherwise. We predict the coefficient on *XBRL* (β_1) to be negative. Firm's market value (*LMV*) is included in the model to control for firm size. Prior research documents a significant association between market value and both disclosure level and CofE (Botosan and Plumlee, 2002). Market value is inherently inversely related to risk, accordingly, we expect its coefficient to be negative. *BETA* is included to control for risk. Greater risk is associated with higher CofE (Francis *et al.*, 2008) so we expect that the coefficient on *BETA* to be positive. We include leverage (*LEV*) because prior research suggests that as the amount of debt in the firm's capital structure increases, risk increases (Botosan and Plumlee, 2005). We expect its coefficient to be positive. Contrary to leverage, return on assets (*ROA*) is negatively associated with firm risk. The higher ROA, the lower the default risks and then lower CofE. Hence, we expect its coefficient to be negative.

5. Sample selection and descriptive statistics

Sample data for voluntary XBRL filers are collected from the SEC Interactive Data Disclosure web site (www.sec.gov/Archives/edgar/monthly), where a complete set of all historical and monthly interactive data filings are available. We select sample for the period from April 2005 (when the SEC launched the VFP) to June 2009 (when the SEC started requiring mandatory XBRL filing). To be included in the sample, we require firms to have analyst consensus EPS forecasts (median) for at least two periods ahead. We further require all necessary financial data available from Compustat Fundamental Annual database to calculate test variables. Annual firm beta was obtained from CRSP Daily Indices database.

As of June 30, 2009, 165 firms have voluntarily submitted at least one filing in XBRL format to the SEC Interactive Data Viewer web site. We delete 11 firms that are foreign-domiciled and 33 firms that are investment management companies[3], and 13 firms that do not have sufficient financial data in Compustat or forecast data in I\B\E\S, or do not produce positive CofE estimates. As shown in Table I, the sample selection procedures yielded a sample of 106 unique XBRL firms. The final sample consists of these 106 voluntary XBRL adopters and 106 non-XBRL control firms in the same fiscal year. The control peer firms are matched by two-digit SIC code, closest total assets, and same fiscal yearend.

As shown in Panel A of Table II, our 106 sample firms are fairly dispersed across 35 industries. Nevertheless, the industry of chemicals and allied products, with ten voluntary XBRL firms (representing 9.43 percent of total sample), dominates other sectors. Followed by business services with nine firms (8.49 percent), electric, gas, and sanitary services with eight firms (7.55 percent), and the electronic, electrical

	No. of firms	%
Public firms voluntarily filing in XBRL format in 2005-2008	165	100
Foreign-domiciled firms	− 11	− 7
Investment companies	− 33	− 20
Firms with insufficient Compustat financial or I\B\E\S forecast data	*− 15*	*− 9*
Final sample of XBRL firms	106	64
Control firms (matched by two-digit SIC code and firm size)	106	
Full sample with matched pairs	212	

Notes: This table describes the sample data selection process; a list of 165 firms voluntarily filing in XBRL format was obtained from the SEC's web site at: www.sec.gov/Archives/edgar/monthly, where a complete set of all monthly and historical interactive data filings are available; among the 165 firms, 11 were foreign-domiciled firms, 33 US firms were investment companies, and 15 firms do not have sufficient financial data in Compustat or earnings forecast data in I\B\E\S; for each of the remaining 106 firms, a matched pair (matched by two-digit SIC code, same fiscal yearend date, and closest firm size in the same fiscal year) was obtained; the final sample contains 212 firm-year observations

Table I. Sample selection procedures

equipment and components with seven firms (6.60 percent). The industry membership indicates that voluntary XBRL filers tend to be high-technology intensive. For example, the business services industry includes firms like Adobe and Microsoft that specializes in developing XBRL software and related products, so it is natural that they are among the earliest firms to adopt the XBRL reporting technology.

Panel B of Table II shows sample distribution of the number of XBRL firms and reports by year. The number of XBRL filers has increased from eight, to 18, to 20, and to 46 firms in years from 2005 through 2008, and there are already 14 firms adopted XBRL in the first half of 2009. The number of financial reports filed in XBRL format by the sample of firms has also increased from 25 reports in 2005 to 179 reports in 2008, and another 124 reports filed in the first half of 2009, bringing a total of 513 reports. Panel C of Table II shows the 513 filings by report type, 137 annual reports (10-K), and 376 quarterly reports (10-Q).

Table III shows the descriptive statistics for the sample of 106 firms voluntarily filing in XBRL format and 106 non-XBRL firms, with a comparison of sample mean and quartile distributions for each key variable of interest between the two groups. The mean *CofE* for XBRL filers is lower (0.124) than the mean of non-XBRL firms (0.148), and the difference is statistically significant (with two-sided p-value = 0.090), consistent with the hypothesis. The significant difference in both means and medians between the XBRL filers and the non-XBRL firms is also found for market value (*LMV*). Not surprisingly, larger firms tend to be early voluntary XBRL filers.

Table IV reports Pearson correlations for test variables of the full sample. We find a significant positive association between *CofE* and *BETA*. The correlation between *CofE* and the indication of XBRL adoption is −0.098, significant with p-value = 0.034. Furthermore, *CofE* is negatively associated with market value of equity and ROA, and positively correlated with leverage (all with p-value < 0.005). It also indicates that certain independent variables are correlated with each other, namely, *BETA* is significantly and negatively correlated with *LMV*, and *ROA* is positively correlated with *LMV* and negatively correlated with *BETA* and *LEV*. However, the correlation coefficients are insignificant (less than 0.30) so multicollinearity should not be an issue here. In fact, collinearity diagnostics show that the VIF is less than 8, indicating less significant multicollinearity.

Panel A. XBRL sample breakdown by industry

SIC	Industry description	By no. of filers No.	By no. of filers %	By no. of reports No.	By no. of reports %
56	Apparel and accessory stores	1	0.94	1	0.19
52	Building materials, hardware, garden supply, and mobile	1	0.94	9	1.75
73	Business services	9	8.49	89	17.35
28	Chemicals and allied products	10	9.43	43	8.38
12	Coal mining	2	1.89	7	1.36
48	Communication services	5	4.72	32	6.24
60	Depository institutions	3	2.83	6	1.17
58	Eating and drinking places	1	0.94	7	1.36
49	Electric, gas, and sanitary services	8	7.55	22	4.29
36	Electronic, elctrcl eqpmnt and cmpnts, excpt computer eqpmnt	7	6.60	19	3.70
87	Engineering, accounting, research, management and related svcs	1	0.94	11	2.14
20	Food and kindred products	4	3.77	22	4.29
54	Food stores	1	0.94	5	0.97
80	Health services	1	0.94	4	0.78
16	Heavy cnstrctn, except building construction – contractors	1	0.94	3	0.58
67	Holding and other investment offices	3	2.83	12	2.34
35	Industrial and commercial machinery and computer equipment	5	4.72	26	5.07
64	Insurance agents, brokers and services	1	0.94	2	0.39
63	Insurance carriers	4	3.77	6	1.17
24	Lumber and wood products, except furniture	1	0.94	1	0.19
38	Mesr/anlyz/cntrl instrmnts; photo/med/opt gds; watch/clocks	3	2.83	13	2.53
10	Metal mining	2	1.89	3	0.58
99	Non-classifiable establishments	1	0.94	11	2.14
13	Oil and gas extraction	5	4.72	18	3.51
26	Paper and allied products	2	1.89	12	2.34
29	Petroleum refining and related industries	2	1.89	5	0.97
33	Primary metal industries	2	1.89	8	1.56
27	Printing, publishing and allied industries	2	1.89	26	5.07
40	Railroad transportation	1	0.94	2	0.39
62	Security and commodity brokers, dealers, exchanges and services	7	6.60	31	6.04
21	Tobacco products	2	1.89	14	2.73
45	Transportation by air	1	0.94	3	0.58
37	Transportation equipment	4	3.77	37	7.21
47	Transportation services	1	0.94	1	0.19
44	Water transportation	2	1.89	2	0.39
Total		106	100	513	100

Panel B. XBRL sample breakdown by year

Year	No. of filers No.	No. of filers %	No. of reports No.	No. of reports %
2005	8	7.55	25	4.87
2006	18	16.98	107	20.86

Table II.
Sample distribution

(*continued*)

2007		20	18.87	78	15.20
2008		46	43.40	179	34.89
June-2009		14	13.21	124	24.17
Total		106	100	513	100

Panel C. Number of XBRL reports by type

Reports	*Report form*	*No.*	*%*
Annual	10-K	137	26.71
Quarterly	10-Q	376	73.29
Total		513	100

Notes: This table describes the distribution of sample XBRL firm-year observations by industry membership, year, report type and frequency; industry names are taken from Occupational Safety and Health Administration (OSHA), US Department of Labor at: www.osha.gov/pls/imis/sic_manual.html; Panel A lists distribution of XBRL filers by industry (two-digit SIC code); Panel B provides the sample distribution by year; Panel C provides the sample distribution by report type

Table II.

6. Empirical results

Main results

Table V presents results of regression of equation (2). The coefficient on *BETA* is significantly positive and its magnitude indicates a market premium of 6.4 percent. The coefficient on *LMV* is -0.019 and is significant, suggesting that one unit increase in firm size as measured by the natural log of market value is associated with approximately 1.9 percent decrease in the CofE. The direction of association between *CofE* and *LEV* and *ROA* is consistent with our prediction, and the associations are significantly different from zero (with one-tailed *p*-value of 0.015 and 0.081, respectively).

The key variable of interest is the XBRL indicator. The coefficient on XBRL (β_1) is -0.017 and the negative association is statistically significant (with one-tailed *p*-value = 0.038). Its magnitude suggests that on average firms voluntarily adopting XBRL experience a significant reduction of cost of equity capital by 1.7 percent after controlling for market value of equity, market beta, financial leverage, and ROA. In sum, the results suggest that CofE for voluntary XBRL filers is lower as compared to that of their non-XBRL pairs. The findings echo the SEC's assertion that XBRL adoption benefit filers and their shareholders by reducing the CofE.

Robustness checks

To find the robustness of the primary analysis, we conduct four additional analysis:

(1) a change model in pre- vs post-voluntary adoption period;

(2) alternative measures of CofE;

(3) Heckman (1979) two-stage regression procedure to control for potential self-selection bias in sampling process; and

(4) deleting firms in the utilities and financial services industries.

In the primary analysis, we measure *CofE* during post-XBRL period; specifically we estimate *CofE* at the fiscal year end of last XBRL filing and compare with the *CofE* estimates of non-XBRL firms. However, it is possible that the difference in CofE between XBRL firm and their non-XBRL pairs may have already existed before

Table III.
Descriptive statistics

Descriptive statistics: XBRL filers and matched pair of firms

Variables	Voluntary XBRL firms $n = 106$ Mean	Quartile 25%	50%	75%	SD	Matched pair of firms $n = 106$ Mean	Quartile 25%	50%	75%	SD	*t*-test Two-tail *p*-value	Wilcoxon test Two-tail *p*-value
CofE	0.1240	0.0711	0.0878	0.1276	0.0878	0.1482	0.0823	0.0999	0.1778	0.1416	0.090	0.080
LMV	9.2095	8.4052	9.2032	10.2437	1.5605	8.5848	7.7042	8.9581	9.6110	1.7075	0.006	0.009
BETA	1.2338	0.7344	1.1551	1.7085	0.6472	1.1469	0.5744	1.0050	1.6811	0.0701	0.349	0.230
LEV	0.6182	0.4936	0.6058	0.7506	0.2352	0.6235	0.5009	0.6213	0.7414	0.2177	0.863	0.711
ROA	0.0389	0.0111	0.0416	0.0874	0.1071	0.0356	0.0036	0.0271	0.0668	0.0898	0.809	0.164
Nfiling	4.8396	2.0000	3.0000	7.0000	4.2340	0.0000	0.0000	0.0000	0.0000	0.0000	<0.001	<0.001
Asset	52,225	4,489	17,898	39,535	131,611	47,864	3,958	15,565	39,033	124,166	0.380	0.372

Notes: This table reports the descriptive statistics on key variables for the sample of 106 XBRL firms and non-XBRL matched pairs; the *t*-test tests the null hypothesis that the mean difference on key variables across XBRL and non-XBRL firms is zero; the Wilcoxon test is a non-parametric method testing the null hypothesis that the median difference on key variables across XBRL and non-XBRL firms is zero; the *p*-values are two-sided; variable definitions: *CofE* is the firm's cost of equity capital calculated based on Easton (2004) model; *LMV* is the natural logarithm of the firm's market value of equity at fiscal year end of last XBRL filing; *BETA* is the firm's annual beta reported in CRSP Indices database; *Nfiling* is number of financial reports filed in XBRL format during the sample period from April 2006 to June 2009; *LEV* is financial leverage computed as the total liabilities divided by total assets at fiscal year end of last XBRL filing; *ROA* is return on assets measured as net income before extraordinary items divided by lagged total assets at fiscal yearend of last XBRL filing; *Asset* is the firm's total assets at year end

	CofE	*XBRL*	*Nfiling*	*LMV*	*BETA*	*LEV*	*ROA*
XBRL	−0.0980	1.0000					
	0.034						
Nfiling	−0.0780	0.6304	1.0000				
	0.092	*< 0.001*					
LMV	−0.3193	0.1884	0.1335	1.0000			
	< 0.001	*0.006*	*0.052*				
BETA	0.4090	0.6458	−0.0026	−0.1686	1.0000		
	< 0.001	*0.350*	*0.970*	*0.014*			
LEV	0.1954	−0.0119	−0.0305	0.0509	0.1292	1.0000	
	0.004	*0.863*	*0.658*	*0.461*	*0.060*		
ROA	−0.3025	0.0167	0.0403	0.3042	−0.3025	−0.2774	1.0000
	< 0.001	*0.809*	*0.560*	*< 0.001*	*< 0.001*	*< 0.001*	

Notes: This table reports Pearson correlation between pairs of dependent variables and independent variables based on a sample of 212 firm observations; *p*-values (in italics) are two-tailed; variables definitions: *XBRL* is an indicator variable which equals 1 if firm observation is during the year of XBRL filing, and 0 otherwise; *CofE* is the firm's cost of equity capital calculated based on Easton (2004) model; *LMV* is the natural logarithm of the firm's market value of equity at fiscal year end of last XBRL filing; *BETA* is the firm's annual beta reported in CRSP Indices database; *Nfiling* is number of financial reports filed in XBRL format during the sample period from April 2005 to June 2009; *LEV* is financial leverage computed as the total liabilities divided by total assets at fiscal year end of last XBRL filing; *ROA* is return on assets measured as net income before extraordinary items divided by lagged total assets at fiscal year end of last XBRL filing

Table IV.
Pearson correlations

	Predicted sign	Estimated coefficient	*t*-value	One-sided *p*-value
$CofE_{it} = \alpha_0 + \beta_1 XBRL_{it} + \beta_2 LMV_{it} + \beta_3 BETA_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + e_{it}$				
Intercept		0.193	4.12	0.000
XBRL	−	−0.017	−1.77	0.038
LMV	−	−0.019	−3.55	<0.000
BETA	+	0.064	5.11	<0.001
LEV	+	0.081	2.19	0.015
ROA	−	−0.128	−1.40	0.081
Industry fixed effect included				
Adj. R^2 (%)		24.89		

Notes: This table presents the results of OLS regression based on a sample of 212 observations; *p*-values are one-sided; industry fixed effects (by one-digit SIC code) are included but their coefficients are not reported for simplicity; variable definitions: *XBRL* is an indicator variable which equals 1 if firm observation is during the year of XBRL filing, and 0 otherwise; *CofE* is the estimated cost of equity capital calculated based on Easton (2004) model; *LMV* is the natural logarithm of the firm's market value of equity at fiscal year end of last XBRL filing; *BETA* is the firm's annual beta reported in CRSP Indices database; *LEV* is financial leverage computed as the total liabilities divided by total assets at fiscal year end of last XBRL filing; *ROA* is return on assets measured as net income before extraordinary items divided by lagged total assets at fiscal year end of last XBRL filing

Table V.
Effects of XBRL filing on the cost of equity capital

adopting XBRL (the treatment). Thus, we perform an additional test using a change model to check whether our primary findings are robust to any potential pre-existing condition. For the sample of XBRL firms and their non-XBRL pairs, we compute all necessary variables in equation (2) for pre-XBRL period and all variable estimates for post-XBRL estimates; then we re-run the regression on the changes in the variable estimates. For pre-XBRL estimates, we compute the *CofE* and the same set of control variables for the sample of 106 XBRL filers and the 106 non-XBRL firms for the fiscal year ending 2004, the year before the SEC started the VFP. Our change model is written as follows:

$$\Delta CofE_{it} = \beta_0 + \boldsymbol{\beta_1 XBRL_{it}} + \beta_2 \Delta LMV_{it} + \beta_3 \Delta BETA_{it} + \beta_4 \Delta LEV_{it} + \beta_5 \Delta ROA_{it} + e_{it} \quad (3)$$

We run the above multivariate regression based the same sample from the primary analysis and the results are reported in Panel A of Table VI. The coefficient on XBRL is -0.0169 and the negative association is significantly different from zero (one-tailed p-value $= 0.045$). Thus, the results of the primary analysis persist and are robust to the pre-existing conditions.

Because potentially there is substantial measurement error and bias in implied CofE estimates, we conduct our second robustness test by using an alternative estimate of CofE: the "Unrestricted Abnormal Earnings Growth" model proposed by Gode and Mohanram (2003). We rerun the regression equation (2). Panel B shows the results of this supplemental analysis. The coefficient of *CofE* on XBRL is -0.0180, and the negative β_1 is statistically significant (with one-tailed p-value of 0.046). In addition, we also use a new alternative measure of implied CofE, developed by Hou *et al.* (2012), the results, untabulated for the reason of brevity, are statistically consistently with the primary results documented in Tables V and VI.

Firms voluntarily adopting XBRL format do not represent a randomly selected sample, so the cross-sectional comparison between XBRL vs non-XBRL firms is subject to potential self-selection bias. Therefore, we use the Heckman (1979) two-stage regression procedure to control for the self-selection effect. In the first stage, we estimate a probit model of voluntary XBRL filing. The dependent variable is a dummy variable with a value of one for voluntary XBRL filers and zero otherwise, and the independent variables are factors influencing firms' decision to voluntarily adopt XBRL based on Tan and Shon (2009). The probit model is as follows:

$$XBRL_{it} = \beta_0 + \beta_1 LMV_{it} + \beta_2 MTB_{it} + \beta_3 LAsset_{it} + \beta_4 VAR_{it} + \beta_5 ROA_{it} + \beta_6 LEV_{it} + \beta_7 AssetLIQ_{it} + \beta_8 TECH_{it} + e_{it} \quad (4)$$

where:

MTB_{it} = market-to-book ratio at fiscal yearend.

$LAsset_{it}$ = the natural logarithm of total assets.

VAR_{it} = stock return volatility computed as the annual standard deviation of daily return during the fiscal year.

$AssetLIQ_{it}$ = liquidity ratio measured as current assets divided by current liabilities.

	Predicted sign	Estimated coefficient	*t*-value	One-sided *p*-value
Panel A. Regression on the change model				
$\Delta CofE_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 \Delta LMV_{it} + \beta_3 \Delta BETA_{it} + \beta_4 \Delta LEV_{it} + \beta_5 \Delta ROA_{it} + e_{it}$				
Intercept		0.1875	3.67	<0.001
XBRL	−	−0.0169	−1.70	0.045
LMV	−	−0.0185	−3.55	<0.001
BETA	+	0.0638	5.11	<0.001
LEV	+	0.0813	2.19	0.015
ROA	−	−0.1282	−1.40	0.081
Adj. R^2 (%)		22.17		
Panel B. Estimate *CofE* using Gode and Mohanram (2003)				
$CofE_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 LMV_{it} + \beta_3 BETA_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + e_{it}$				
Intercept		0.0949	3.02	0.001
XBRL	−	−0.0180	−1.70	0.046
LMV	−	−0.0058	−1.41	0.079
BETA	+	0.0622	5.84	<0.001
LEV	+	0.0062	0.23	0.410
ROA	−	−0.0557	−0.84	0.200
Adj. R^2 (%)		20.71		
Panel C. Control for potential self-selection bias using Heckman (1979)				
$CofE_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 LMV_{it} + \beta_3 BETA_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + \beta_6 IMR_{it} + e_{it}$				
Intercept		0.0610	3.97	0.000
XBRL	−	−0.0160	−1.81	0.036
LMV	−	−0.0024	−0.61	0.136
BETA	+	0.0233	2.14	0.009
LEV	+	0.0404	0.81	0.009
ROA	−	−0.0764	−0.64	0.062
IMR		0.1609	2.38	0.010
Adj. R^2 (%)		29.41		
Panel D. Regression using a subsample of firms after deleting utilities and financial services industry				
$CofE_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 LMV_{it} + \beta_3 BETA_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} + e_{it}$				
Intercept		0.1952	3.98	<0.001
XBRL	−	−0.0169	−1.68	0.047
LMV	−	−0.0185	−3.55	<0.001
BETA	+	0.0638	5.11	<0.001
LEV	+	0.0813	2.19	0.015
ROA	−	−0.1282	−1.40	0.081
Adj. R^2 (%)		24.76		

Notes: This table reports the results for additional sensitivity tests; Panel A represents the regression results on the change model (106 firms); Panel B reports the results of OLS regression based on the estimates of *CofE* using Gode and Mohanram (2003) model (based on a sample of 106 firms); Panel C reports the regression results after controlling for self-selection bias using Heckman (1979) (based on a sample of 106 firms); Panel D provides the regression results based on a subsample that excludes utilities and financial services industries (80 firms); *p*-values are one-sided; industry fixed effects (by one-digit SIC code) are included but their coefficients are not reported for simplicity; variable definitions: *XBRL* is an indicator variable which equals 1 if firm observation is during the year of XBRL filing, and 0 otherwise; *CofE* is the estimated cost of equity capital calculated based on Easton (2004) model except Panel B using Gode and Mohanram (2003); *LMV* is the natural logarithm of the firm's market value of equity at fiscal year end of last XBRL filing; *BETA* is the firm's annual beta reported in CRSP Indices database; *LEV* is financial leverage computed as the total liabilities divided by total assets at fiscal year end of last XBRL filing; *ROA* is return on assets measured as net income before extraordinary items divided by lagged total assets at fiscal year end of last XBRL filing

Table VI.
Sensitivity tests

$TECH_{it}$ = an indicator variable with the value of 1 if firm is in high-technology industry, 0 otherwise. Hi-tech industries are with SIC code in the 2830s, 3570s, 7370s, 8730s, and between 3825 and 3829.

All other variables are previously defined.

The results (untabulated) show that in the first stage the coefficients on *LMV*, *VAR*, *ROA*, *LEV*, *AssetLIQ* and *TECH* are statistically significant from zero, while the coefficients on *LAsset* and *MTB* are not significant. In the second stage, we include the inverse Mills ratio (*IMR*) based on the first stage results as an additional explanatory variable in the regression model (2). Results of the regression analysis in the second stage are reported in Panel C of Table VI. The adjusted R^2 is 29.41 percent. As compared to results reported in Table V ($R^2 = 24.89$ percent), the new model gains higher explanatory power after including *IMR*. The coefficient on XBRL (β_1) is -0.016 and it is statistically significant (one-sided p-value is 0.036). This indicates that, after controlling for the self-selection bias, we obtain similar results comparing with the primary analysis.

In comparison to industrial firms, utilities and financial service firms are subject to different regulations and reporting standards, hence voluntary adoption of XBRL adoption may have a different impact on firms' CofE. To ensure that our results are not driven by these firms, we deleted firms in utilities and financial service industries (with SIC2 49 and 60-69). As the result, we obtain a sample of 80 XBRL filers. For each XBRL firm, we match with a pair of non-XBRL firm using the same procedure as specified previously. We re-estimate regression equation (2) with the pooled new sample of 160 firms. Results are reported in Panel D. Consistent with those reported in Table V, CofE is negatively correlated with XBRL adoption, and the correlation is marginally significant (with one-tailed p-value of 0.047). Therefore, our primary conclusion is robust to samples excluding utilities and financial service firms.

7. Conclusion

The purpose of this study is to investigate the association between XBRL reporting standard and cost of equity capital. We find that cost of equity capital is negatively and significantly associated with the voluntary XBRL filing. The magnitude of the coefficient on XBRL suggests that firms voluntarily adopting XBRL are associated with an average reduction in cost of equity capital by 1.7 percent point after controlling for market value of equity, market beta, financial leverage and return on assets. Our results persist after we use alternative cost of equity capital measures and various model specifications.

This study is subject to some limitations. First, firms' CofE is unobservable and prior research indicates the difficulty of its measurement empirically. For this reason, there is potential measurement error in computation. Second, due to short period of voluntary adoption of XBRL and data availability issue, our sample size is small and most are large firms. Thus, the results may not fully capture the economic consequence of voluntary XBRL adoption. Third, prior research indicates certain variables such disclosure qualities, liquidity, and corporate governance are strongly associated with CofE, but they are excluded from analysis due to data availability (Souissi and Khlif, 2012). Albeit the limitations, we provide early evidence that the adoption of XBRL can lower cost of equity capital.

Notes

1. "About the organization", available at: www.xbrl.org (accessed July 12, 2010).
2. "What is interactive data and who's using it", available at: www.sec.gov/spotlight/xbrl/what-is-idata.shtml
3. These are firms that file Form 6k and Form N-1A, respectively.

References

Baldwin, A., Brown, C. and Trinkle, B. (2006), "XBRL: an impacts framework and research challenge", *Journal of Emerging Technologies in Accounting*, Vol. 3 No. 1, pp. 97-116.

Barth, M., Konchitchki, Y. and Landsman, W. (2013), "Cost of capital and earnings transparency", working paper, Stanford University, Stanford, CA, January 23.

Bartley, J., Chen, A. and Taylor, E. (2011), "A comparison of XBRL filings to corporate 10-Ks: evidence from the voluntary filing program", *Accounting Horizon*, Vol. 25 No. 2, pp. 227-245.

Boritz, J.E. and No, W.G. (2008), "SEC's XBRL voluntary program on EDGAR: a case for quality assurance", *Current Issues in Auditing*, Vol. 2 No. 2, pp. A36-A50.

Botosan, C. (1997), "Disclosure level and the cost of equity capital", *The Accounting Review*, Vol. 72 No. 3, pp. 323-349.

Botosan, C. and Plumlee, M. (2002), "A re-examination of disclosure level and expected cost of equity capital", *Journal of Accounting Research*, Vol. 40 No. 1, pp. 21-40.

Botosan, C. and Plumlee, M. (2005), "Assessing alternative proxies for the expected risk premium", *The Accounting Review*, Vol. 80 No. 1, pp. 21-53.

Debreceny, R.S., Chandra, A., Cheh, J.J., Guithues-Amrhein, D., Hannon, N.J., Hutchison, P.D., Janvrin, D., Jones, R.A., Lamberton, B., Lymer, A., Mascha, M., Nehmer, R., Roohani, S., Srivastava, R.P., Trabelsi, S., Tribunella, T., Trites, G. and Vasarhelyi, M.A. (2005), "Financial reporting in XBRL on the SEC's EDGAR system: a critique and evaluation", *Journal of Information Systems*, Vol. 19 No. 2, pp. 191-210.

Easton, P. (2004), "PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital", *The Accounting Review*, Vol. 79 No. 1, pp. 73-95.

Efendi, J., Smith, M. and Wong, J. (2011), "Longitudinal analysis of voluntary adoption of XBRL on financial reporting", *International Journal of Economics and Accounting*, Vol. 2 No. 2, pp. 173-189.

Francis, J., Nanda, D. and Olsson, P. (2008), "Voluntary disclosure, earnings quality, and cost of capital", *Journal of Accounting Research*, Vol. 46 No. 1, pp. 53-99.

Gode, D. and Mohanram, P. (2003), "Inferring cost of capital using the Ohlson-Juettner model", *Review of Accounting Studies*, Vol. 8 No. 4, pp. 399-431.

Han, M. and McKelvey, B. (2008), "Toward a social capital theory of technology-based new ventures as complex adaptive systems", *International Journal of Accounting and Information Management*, Vol. 16 No. 1, pp. 36-61.

Heckman, J. (1979), "Sample selection bias as a specification error", *Econometrica*, Vol. 47 No. 1, pp. 153-161.

Hodge, F.D., Kennedy, J.J. and Maines, L.A. (2004), "Does search-facilitating technology improve the transparency of financial reporting", *The Accounting Review*, Vol. 79 No. 3, pp. 687-703.

Hou, K., van Dijk, M.A. and Zhang, Y. (2012), "The implied cost of capital: a new approach", *Journal of Accounting and Economics*, Vol. 53 No. 2, pp. 504-526.

Lambert, R., Leuz, C. and Verrecchia, R. (2007), "Accounting information, disclosure, and the cost of capital", *Journal of Accounting Research*, Vol. 45 No. 2, pp. 385-420.

Li, Y., Roge, J., Rydl, L. and Crews, M. (2006), "Information technology addresses transparency: the potential effects of XBRL on financial disclosure", *Issues in Information Systems*, Vol. 7 No. 2, pp. 241-245.

Malhotra, R. and Garritt, F. (2004), "Extensible business reporting language: the future of e-commerce-driven accounting", *International Journal of Business*, Vol. 9 No. 1, pp. 59-82.

Pinsker, R. and Li, S. (2008), "Costs and benefits of XBRL adoption: early evidence", *Communications of the ACM*, Vol. 51 No. 3, pp. 47-50.

Plumlee, R. and Plumlee, M. (2008), "Assurance on XBRL for financial reporting", *Accounting Horizons*, Vol. 22 No. 3, pp. 353-368.

Premuroso, R. and Bhattacharya, S. (2008), "Do early and voluntary filers of financial information in XBRL format signal superior corporate governance and operating performance?", *International Journal of Accounting Information Systems*, Vol. 9 No. 1, pp. 1-20.

SEC (2005), *XBRL Voluntary Financial Reporting Program on the EDGAR System*, Release Nos. 33-8529, Securities and Exchange Commission, Washington, DC.

SEC (2008), *Interactive Data to Improve Financial Reporting*, Release Nos. 33-9002, Securities and Exchange Commission, Washington, DC.

Souissi, M. and Khlif, H. (2012), "Meta-analytic review of disclosure level and cost of equity capital", *International Journal of Accounting and Information Management*, Vol. 20 No. 1, pp. 49-62.

Srivastava, R. and Kogan, A. (2010), "Assurance on XBRL instance document: a conceptual framework of assertions", *International Journal of Accounting Information Systems*, Vol. 11, pp. 261-273.

Tan, C. and Shon, J. (2009), "XBRL and its financial reporting benefits: capital market evidence", working paper, Fordham University, New York, NY, January 24.

XBRL.org (2002), "XBRL: understanding the XML standard for business reporting and finance", White Paper, available at: www.xbrl.org/Business/General/SoftwareAG-CaseForXBRL.pdf (assessed December 29, 2009).

Corresponding author
Joseph H. Zhang can be contacted at: jzhang5@memphis.edu