



## The impact of XBRL adoption in PR China



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### ABSTRACT

EXtensible Business Reporting Language (XBRL) is expected to develop into the global data standard for business financial reporting with the potential to change the way that decisions are made. Thus, understanding its value realization in the proper business context is a vitally important issue. This study examines the impact of initial mandatory adoption of XBRL on organizations' cost of capital and transaction costs in PR China. As transaction cost theory predicts, the uncertainty related to the unproven technology increases transaction costs and the cost of capital during the early adoption period. Implications have immediate benefits for regulators, filing organizations, information consumers, the accounting profession, and other stakeholders.

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### 1. Introduction

Understanding the business value of information technology (IT) or IT standard such as eXtensible Business Reporting Language (XBRL) is a vitally important issue in today's technology-intensive world [41]. Measurements of business value include productivity, output, corporate earnings, growth, funding position, return on assets, etc. [2,38,58,69,80]. There is a need to represent IT's value in a business context to capture the interactions between IT and the business environment [41]. XBRL, ranked as one of the top ten technologies for accounting and auditing professionals by the American Institute of Certified Public Accountants [59], has been recently developed as a potential global data standard for business financial reporting. This is in response to the increasingly important Internet disclosure of businesses' financial information, due to easier and broader circulation of financial data [18]. The U.S. Securities and Exchange Commission estimates that the direct costs to a company submitting its first interactive data financial statements with XBRL with block-text footnotes and schedules can average \$40,510 with an upper bound of \$82,220, while the costs for subsequent block-text filings can average \$13,450 with an upper bound of \$21,340 [71]. Given such adoption related costs, measuring the value realization from XBRL adoption in its proper business context is crucial to the decision for XBRL adoption [19]. Research on the impact of IT or IT standards has contributed to the investigation into justification of IT investments over the last two decades [47].

As a relatively new innovation for web-based financial reporting [22], XBRL is an information technology standard that provides an identifying tag for financial facts such as total sales to create an unambiguous way to identify and compare financial facts of one company to another [31]. By separating content from format, XBRL is expected to benefit all members of the financial information supply chain by making information exchangeable between different applications and systems, and making it easier to extract, search, and reuse information by users [34]. XBRL ushers in an era of financial transformation that has the potential to change the way that businesses are managed [67].

One key value expected of XBRL is cost reduction for organizations. On the one hand, XBRL is expected to reduce the cost of financial information generation by optimizing financial information for machine creation, publication, discovery, consumption, reuse, and communication [4,73]. XBRL facilitates the automated production and consumption of large volumes of business performance information by combining the immediacy and reach of the Web, with the ability of information consumers to incorporate corporate information directly into their data warehouses and decision models [17]. Many expect XBRL to reduce re-keying of information for e-Commerce [63]. XBRL is also designed to enhance the efficiency, reliability, and accuracy of electronic communication of relatively interactive business financial data [4,73,75,81]. Improved efficiency, reliability, and accuracy of business information reduce the cost of capital [21,23,25]. Therefore, Premuros and Bhattacharya [66] believe that the primary motivation for and value from filing in XBRL is related to lowering an organization's cost of capital.

Despite the potential of XBRL, whether adopters are realizing its value or promises is still an empirical question. Previous studies

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examining the “IT productivity paradox”, a weak link between business value and information technology, reveal that new technology takes time for fine-tuning and value realization [47,50]. Bovee et al. [11] find significant variations of quality across financial statements and industries among organizations using the year 2000 version of XBRL. Understanding the business value of XBRL is a vitally important issue for regulators, adopting organizations, and investors.

Based on transaction cost theory, this study conducts an empirical investigation into the claimed cost reduction benefit of initial mandatory XBRL adoption in China to provide helpful information to security regulators who are considering the mandatory adoption of XBRL in their jurisdictions. The impact of XBRL on the cost of capital in China is particularly interesting not only because China is the first country to mandate XBRL adoption [37], but also because China has the third highest market capitalization in the world, as per Bloomberg. As the largest and fastest growing emerging market and the second largest economy in the world, China is increasingly important to investors around the world [49,52]. Therefore, the business value implications of XBRL in China are particularly important.

Chinese organizations adopting XBRL under the 2004 mandate are analyzed to assess the adoption's impact on the cost of capital. The research is among the first to empirically test the impact of information technology (IT) on market efficiency to initiate a new direction in IT value realization research. Building on transaction cost theory, this paper explores the impact of IT adoption. Findings can be informative to regulators, investors, and potential adopting organizations. Potential adopters of IT-related innovation normally evaluate an innovation in terms of whether the likely benefits outweigh the costs of adoption [65]. The findings will provide useful information to businesses about the likely benefits and costs from XBRL adoption.

## 2. XBRL adoption background and literature review in IT value realization and transaction cost theory

### 2.1. World adoption of XBRL

XBRL was initiated in 1998 by Charles Hoffman. Since 2001, many XBRL jurisdictions have supported the development of XBRL. China started to assess XBRL adoption as early as 2002. In 2004, China was the first country in the world to formally require XBRL for all public companies' financial reporting [37]. Subsequently, numerous countries also joined in as the early adopters. Spain mandated the switch to XBRL to coincide with the adoption of IFRS in July 2005 [57]. South Korea developed a mandatory filing program in October 2007 [81]. Singapore mandated XBRL filing in November 2007 [57]. Israel also chose to coincide its switch to XBRL with its adoption of IFRS in January 2008 [57]. Belgium mandated XBRL for reporting in January 2008 [57]. Luxembourg started XBRL mandatory filing from January 2008 [57]. Japan switched to XBRL filing in April 2008 [57]. India started a phase-in adoption by mandating XBRL filing for the top 100 Indian companies in January 2008 [57]. The U.S. SEC mandated a phase-in process for essential reporting with XBRL to begin for a fiscal period ending on or after June 15, 2009 for the top 500 public organizations [72]. The second phase requires all companies with a public float of more than \$700 million to use XBRL by June 15 of 2010. The third phase requires all U.S. public companies to use XBRL starting June 2011. Standard Business Reporting from businesses to the government of Australia started to use XBRL in July 2010 [57]. Chile and Germany also mandated XBRL adoption in 2010. XBRL is mandatory for firm reports in Denmark and UK in 2011 [57]. With the increasing number of jurisdictions mandating XBRL adoption, value realization or impact from such an adoption becomes a pressing research topic.

Regulators in many jurisdictions, such as Canadian Securities Administrators, are still assessing the costs and benefits of XBRL adoption. The level of mandatory XBRL adoption is sometimes considered to be disappointing when compared with the early predictions

made for XBRL's success [36]. One possible reason is the lack of empirical evidence on costs and benefits of the unproven technology and the uncertainty resulting thereof. This study contributes to the field by investigating early XBRL adoption, benefits and value based on empirical data.

### 2.2. IT value realization literature

As per [66], the primary advantage of filing in XBRL relate to lowering adoption organizations' cost of capital by reducing investor uncertainty about the quality of the firm and the expected returns from its securities. XBRL International claims that organizations experience a reduction in their cost of capital because of improved, transparent, and real-time financial reporting in the XBRL format [79]. Removal of errors from duplicative data entry can improve the quality and transparency of information and thus reduce information asymmetry and cost of capital. This is because improved transparency can reduce the uncertainty and risk of providing capital to a firm and lower its cost of capital [62,81,82]. XBRL also promises to reduce investors' costs of obtaining and assimilating information from businesses because it optimizes financial information for machine creation, discovery, comparison, and reuse [81]. Many expect the development of standards like XBRL to lower the cost of electronic connection and spur adoption [77]. However, empirical evidence of realized value from XBRL is yet to be reported.

Extant research reveals that the value of IT innovation takes time to realize its benefits or value, as time is necessary to fine-tune a new technology, to learn the technology, and to readjust in an organization [68]. Earlier studies of value realization from IT innovation fail to find a strong evidence of value, and introduced the concept of an 'IT productivity paradox', which refers to a weak link between IT and value [30,58,70]. Im et al. [33] find a positive value realization from IT investment in the early 1990s to replace the productivity paradox present in the 1980s. Kivijarvi and Saarinen [38] find that investment in information systems has long-term delayed effects on profitability. Yao et al. [80] also uncovers more evidence of value realized from IT investment with more recent data over 1998–2000. As a new IT technology, XBRL may also take some time before its value can materialize.

Recent studies of early XBRL adoption reveal that XBRL, as an unproven technology, has yet to be fine-tuned. For example, when the XBRL taxonomy is more aggregated than managers prefer, using the taxonomy may lead to loss of information [11]. XBRL still faces a challenge in terms of network externality because of differences between XBRL for external reporting and XBRL for internal recording systems, since uncertainty in accurate mapping between the two damages the intrinsic value of both forms of XBRL [55]. Besides, the continuing uncertainty over rendering of XBRL tagged information with a standardized method for the presentation of XBRL instance documents in human-readable form poses difficulties in the use of XBRL [1]. As solutions appear to address challenges like these, the XBRL specification itself goes through significant changes, necessitating costly redevelopments and compatibility problems for software vendors and disrupting normal reporting processes [22]. The evolving standards and lack of knowledge of XBRL among accountants and financial experts can hinder value realization from XBRL adoption [28].

There have been mixed findings on the impact of XBRL adoption. Though Yoon et al. [81] find a significant negative association between XBRL adoption and information asymmetry in the Korean stock market, Blankespoor et al. [8] find a significant positive relation between XBRL adoption and information asymmetry as measured by abnormal bid ask spreads in the U.S. Although an empirical examination of firms listed in the U.S. reveals that the mandatory XBRL adoption has led to a significant improvement to both the quantity and quality of information, as measured by analyst following and forecast accuracy [54], Liu et al. [53] disclose that XBRL has decreased analysts' forecast accuracy among Chinese firms. Contingency theory partially explains the mixed results as value realization of a technology depends on the fit

between technology integration and contingent factors in business environments, availability of resources, technological and regulatory environments as soon as a technology crosses national boundaries [35]. Blankespoor [7] finds that XBRL firms in the U.S. increase their quantitative footnote disclosures, consistent with firms anticipating increased investor processing of and demand for disclosures in face of the XBRL mandate. Li et al. [44] study the U.S. firms to find that XBRL filing reduces investors' information processing costs and firms' cost of equity capital, and increases analyst coverage and forecast accuracy among the U.S. firms. Given significant differences between the U.S. and PR China in terms of business and regulatory environments, whether the findings of U.S. firms are applicable to firms operating in China remains an empirical question.

### 2.3. Transaction cost theory

Many researchers [3,6,56] believe that IT, such as XBRL, affects transaction costs, incurred in making economic exchanges, such as buying or selling a stock. Transaction costs refer to the costs involved in transaction-related activities, such as the cost of information search, the cost of negotiating a contract, and the cost of enforcing a contract [76]. Three major dimensions of a transaction can affect transaction costs: uncertainty that defines the extent to which organizations are faced with unforeseen actions, asset specificity that refers to the extent to which durable investments are used to support particular transactions, and frequency of transactions [46,51,78].

Uncertainty in XBRL implementation can increase the cost of capital through decreased information quality and increased transaction costs of trading in a firm's shares. A high degree of change and difficulties associated with the innovation adoption of XBRL generate uncertainty [22,32,45]. Bovee et al. [11] reveal significant variations of quality across financial statements and industries among organizations using the year 2000 version of XBRL taxonomy. Boritz and No [9] find that two-thirds of the XBRL instance documents in the SEC's Voluntary Filing Program contain inconsistencies and errors. Debreceeny et al. [17] uncovers an average of 1.8 errors per filing in a U.S. XBRL filing sample, which has median error of \$9.1 million per filing with the maximum exceeding \$7 billion. Examples of errors include incorrect signs to values or elements in the form of debit/credit reversal, missing fact value in calculation relationships, wrong fact value, failure to establish mathematical relations among elements due to human error or the failure of automated data extraction software with limited interpretative ability [5,17]. Errors in XBRL technology implementation lead to uncertain noise in the reported information. Despite such evidence of errors in XBRL implementation, no requirement has been set up for independent assurance of the XBRL version of financial statements in any regulatory filings around the world [27,64]. Due to the lack of requirement for independent assurance of quality through external audit of XBRL documents, such errors are less likely to be identified or corrected before reports are released. As a result, Li and Pinsker [45] believe that uncertainty associated with XBRL adoption is particularly salient for organizations in economies with weak public information. Liu et al. [53] find that analysts' forecast accuracy decreased among Chinese firms that adopted XBRL. Noise in reported financial information increases information asymmetry and cost of capital [81]. The adoption of XBRL can have a significant impact on transaction costs, such as search costs due to its effect on uncertainty. Information and communication technology like XBRL can lower search costs only if the increased amount of information and/or speed is balanced by an equal increase in its ability to manage, process, and evaluate that information [15,56]. Due to the difficulty in incorporating a firm's paper paradigm filing in the XBRL version of the filing, XBRL adoption allows flexibility in creating taxonomy extensions. Such flexibility decreases comparability of documents for information processing and evaluation and increases search costs [9,15]. Decreased transparency due to errors increases transaction costs, which in turn increases the cost of capital [12,39].

Based on IT value realization literature, transaction cost theory, and recent findings of XBRL implementation, this study hypothesizes:

**H1.** The initial mandatory XBRL adoption in China results in an increased cost of capital.

**H2.** The initial mandatory XBRL adoption in China results in increased transaction costs.

### 3. Research method

Chinese organizations mandated to use XBRL are used as the sample. They are chosen because China is the first country to mandate XBRL for business report filing and is thus an appropriate target market to examine the initial effect of XBRL adoption. Another reason is that unlike organizations elsewhere (e.g. in Spain), XBRL adoption in China does not coincide with the conversion from local accounting standards to International Financial Reporting Standards (IFRS). Thus, the change in the cost of capital identified among Chinese mandatory adopters will not be a result of multiple major changes to the reporting process. Mandatory adoption of XBRL is studied to avoid self-selection bias. Chinese organizations are analyzed because the uncertainty associated with XBRL adoption is especially salient for organizations in economies with limited public information on listed organizations [45]. As the country with the third highest market capitalization in the world, China is increasingly important to investors around the world [49,52]. Therefore, the impact of XBRL adoption in China is relevant to many investors.

Since 1992, China issued four sets of accounting regulations (1992, 1998, 2001, and 2006) with each replacing the previous one with greater conformity to IFRS [60]. The XBRL adoption mandate of 2004 occurred during the period between 2001 and 2006 when the third set of accounting regulations was in effect. Therefore, data are collected between 2001 and 2006 to screen out potential intervening effects due to accounting regulation changes. Organizations adopting XBRL before the 2004 mandate are removed from the sample. The year 2001–2003 data reflect the pre-adoption period while the year 2004–2006 data reflect the post-adoption period. Sample organizations are from different industries: 58% manufacturing industrials, 19% public utilities, 10% conglomerates, 7% commerce, 4% properties, and 2% finance.

Following Li [43], research model (1) identifies the impact of XBRL adoption on the cost of capital, while controlling variables previously found to influence the cost of capital as follows:

$$\begin{aligned} \text{Cost of capital} = & \alpha_0 + \alpha_1 * \text{Post} + \alpha_2 * \text{OTC} + \alpha_3 * \text{EXCH} \\ & + \alpha_4 * \text{SIZE} + \alpha_5 * \text{RETVAR} + \alpha_6 * \text{LEV} \\ & + \alpha_7 * \text{MB} + \alpha_8 * \text{Industry} + \alpha_9 * \text{Firm} + \varepsilon \end{aligned} \quad (1)$$

where Post is a dummy variable equal to 1 for the period since the XBRL adoption mandate and 0 otherwise. OTC and EXCH are indicator variables equal to 1 if a firm is listed in the U.S. over-the-counter markets, or on the NYSE, NASDAQ, or Amex, as per JP Morgan ADR respectively [43]. SIZE is the natural logarithm of total assets at year-end [43]. RETVAR is the return variability computed as the annual standard deviation of monthly stock returns at year-end [43]. LEV is financial leverage based on total liabilities divided by total assets at year-end [43]. Industry is an indicator variable for a firm's industry membership. MB is market-to-book ratio [16,39,44]. Firm is an indicator variable for us to control firm effects on the cost of capital [39]. Cost of capital,  $r$ , is determined with the Price/Earnings to Growth ratio (PEG ratio) based on the implied cost of equity method [24] as in Eq. (2), because [10] concludes that the PEG estimate is one of the most reliable costs of capital proxies. The superior value of PEG ratio is also reflected in its pervasive usage [14,24].

$$r = \sqrt{\frac{(\text{eps}_2 - \text{eps}_1)}{P_0}} \quad (2)$$

where  $r$  is the estimated cost of capital;  $eps_2$  is the forecasted earnings per share at date  $t = 2$ ;  $eps_1$  is the forecasted earnings per share at date  $t = 1$ ;  $P_0$  is the stock price at  $t = 0$ .

Analyst forecasts are obtained from the I/B/E/S International database, while financial accounting information and stock information are obtained from CSMAR databases. The latest forecast is used for each firm year. Firms with missing variable values are removed to result in 291 sample organizations with 591 firm year observations.

As per Lang et al. [39], research model (2) for the impact of XBRL adoption on transaction costs and stock liquidity is as follows:

$$\begin{aligned} \text{transaction cost} = & \beta_0 + \beta_1 * \text{Post} + \beta_2 * \text{OTC} + \beta_3 * \text{EXCH} \\ & + \beta_4 * \text{SIZE} + \beta_5 * \text{RETVAR} + \beta_6 * \text{LEV} \\ & + \beta_7 * \text{MB} + \beta_8 * \text{Industry} + \beta_9 * \text{Firm} + \varepsilon \end{aligned} \quad (3)$$

where transaction cost is measured by the natural log of bid-ask spread, LNSPREAD [16,39,44].

$$\text{LNSPREAD} = \ln \{ (\text{ASK} - \text{BID}) / [(\text{ASK} + \text{BID}) / 2] \} \quad (4)$$

where ASK is the price for an immediate sale and BID is the price for an immediate purchase.

## 4. Research findings

### 4.1. Descriptive statistics

Table 1 summarizes the descriptive statistics about the sample. We winsorize all continuous variables with the 1% and 99% percentile cut-offs. When non-nominal variables are compared between the period without annual XBRL filing (2001–2003) and the period with mandatory annual XBRL filing (2004–2006), difference is not found in firm size or market-to-book ratio. However, the Mann–Whitney test reveals significant differences between the two periods for LEV, RETVAR,  $r$ , and LNSPREAD. The estimated cost of capital,  $r$ , and LNSPREAD is significantly higher in the period after mandatory XBRL adoption as hypothesized.

### 4.2. Model testing

Spearman correlation coefficients among variables (between dependent and independent variables in particular), as presented in Table 2, are all far below 0.80. Tests of tolerance (minimum tolerance = 0.326 for model (1) and 0.258 for model (2)) and variance inflation factor (maximum VIF = 2.808 for model (1) and 3.877 for model (2)) further confirm low multicollinearity in the regression models (1) and (3). Cost

of capital,  $r$ , and LNSPREAD are positively correlated. The positive correlations between “Post” and the dependent variables are significant as hypothesized.

Table 3 shows empirical evidence in support of H1 and H2, as reflected in the significant and positive coefficients for “Post” when other variables known to influence the cost of capital, transaction cost and liquidity, such as firm size, return variability, financial leverage, market-to-book ratio, industry effects, firm effects, and exchange categories, are controlled and included in the research model. In agreement with prior findings, LEV is found to positively relate to the cost of capital [20,43,44] and LNSPREAD [44]; RETVAR is positively associated with LNSPREAD [44]; SIZE is negatively associated with LNSPREAD [44] and cost of capital [43]; and MB is negatively associated with cost of capital [44]. In summary, the empirical findings suggest that early mandatory XBRL adoption in China is associated with a significant increase in the cost of capital and transaction costs as hypothesized.

### 4.3. Robustness tests

To assess the impact of the XBRL adoption mandate with a longer after-adoption period, we test the research models with 2001–2008 data and 2001–2007 data (to remove the influence of financial crisis since 2008). In these robustness tests, an additional indicator variable, Newstandard (1 when new standard is in effect, 0 otherwise), is added to the model to control the effect of the accounting standard that took effect since 2007. These tests reveal similar findings with positive and significant coefficients for Post: 0.027 at  $p < 0.01$  for  $r$  with the 2001–2008 data; 0.028 at  $p < 0.01$  for  $r$  with the 2001–2007 data; 0.179 at  $p < 0.01$  for LNSPREAD with the 2001–2008 data and with the 2001–2007 data.

Since the XBRL adoption effect may be uncertain during the transition period, the models are also tested with the transition period (2003–2004) removed from the 2001–2006 period, as per Li [43] and Petersen [61]. To remove the impact of sample firm differences across periods, we test the models by removing organizations that have data for only one period during 2001–2006. Table 4 shows that the hypotheses are still supported with significant and positive coefficients for “Post.” Conclusions are also the same when we remove sample organizations from the finance industry with positive and significant coefficients for Post: 0.027 at  $p < 0.01$  for cost of capital,  $r$  and 0.183 at  $p < 0.01$  for LNSPREAD. When we use the natural log of market capitalization as the measure for size, the conclusions are the same with positive and significant coefficients for Post: 0.025 at  $p < 0.01$  for cost of capital,  $r$  and 0.175 at  $p < 0.01$  for LNSPREAD.

In addition, two other proxies for the cost of capital are used to retest the model. When modified PEG ratio proxy for cost of capital [24] is used, “Post” is positive at 0.045 and significant with  $p < 0.01$ . When the Gode and Mohanram proxy [26] for the cost of capital is used, “Post” is positive at 0.132 and significant with  $p = 0.02$ .

### 4.4. Cross-sectional portfolio tests

We partition our sample by whether a stock is issued as A share (where A-share = 1) or B share (where A-share = 0), whether a stock is listed on the NYSE, NASDAQ, or Amex exchanges where EXCH = 1, and whether a stock is listed in the U.S. over-the-counter markets where OTC = 1. Organizations issuing A-shares must prepare their financial statements based on Chinese Accounting Standards while B-Share organizations should prepare financial statements following International Accounting Standards and be audited by the Big 5 (now Big 4) international auditing firms [48]. We also partition our sample by other firm attributes in terms of leverage (where LEVH = 1 for the subsample of firms whose LEV or financial leverage is above average LEV; LEVH = 0 otherwise), return variability (where RETVAR = 1 for the subsample of firms whose RETVAR or return variability is above average RETVAR; RETVAR = 0 otherwise), market-

**Table 1**  
Descriptive statistics for non-nominal variables studied.

Complete sample: 2001–2006						
	Mean			Standard deviation (Std)		
LEV	0.478			0.190		
LNSPREAD	−3.324			0.215		
MB	0.003			0.002		
$r$	0.081			0.052		
RETVAR	0.112			0.056		
SIZE	22.202			1.160		
Pre-adoption: 2001–2003						
	Mean	Std	Median	Post-adoption: 2004–2006		
	Mean	Std	Median	Mean	Std	Median
LEV	0.433	0.196	0.448	0.492	0.186	0.500**
LNSPREAD	−3.485	0.208	−3.508	−3.275	0.193	−3.284**
MB	0.003	0.002	0.002	0.003	0.002	0.002
SIZE	22.206	1.109	22.090	22.200	1.176	22.113
RETVAR	0.105	0.085	0.085	0.114	0.044	0.105**
$r$	0.056	0.039	0.051	0.089	0.053	0.079**

\*\* Indicates difference significant at  $p < 0.01$ .

**Table 2**  
Spearman correlation coefficients.

	1	2	3	4	5	6	7	8	9	10	11
<i>Dependent variables</i>											
1 r	1										
2 LNSPREAD	0.218**	1									
<i>Independent variables</i>											
3 Post	0.327**	0.399**	1								
4 OTC	-0.092*	-0.218**	-0.145**	1							
5 EXCH	0.018	-0.147**	-0.083*	-0.060	1						
6 SIZE	-0.017	-0.238**	-0.010	0.342**	0.303**	1					
7 RETVAR	0.138**	0.720**	0.238**	-0.117**	-0.114**	-0.091*	1				
8 LEV	0.201**	0.239**	0.138**	0.038	-0.002	0.334**	0.268**	1			
9 MB	-0.246**	0.263**	-0.136**	-0.115**	-0.127**	-0.327**	0.226**	-0.035	1		
10 Industry	0.118**	0.253**	0.132**	-0.143**	-0.138**	-0.198**	0.219**	0.143**	-0.069	1	
11 Firm	-0.009	0.064	0.106**	-0.019	0.007	-0.055	0.037	0.058	0.111**	0.002	1

\*\* Indicates significance at  $p < 0.01$ .

\* Indicates significance at  $p < 0.05$ .

to-book ratio (where MBH = 1 for the subsample of firms whose MB or market-to-book ratios are above average MB; MBH = 0 otherwise), and SIZE (where SIZEL = 1 for the subsample of firms whose SIZE is above average firm size; SIZEL = 0 otherwise). Table 5 presents the coefficients for “Post” variable for each subsample.

The results reveal differences among firms with different stock listing attributes. The increase to the cost of capital and transaction cost is only experienced by A-share firms but not by B-share firms. In addition, the increase to the cost of capital is not significant for firms listed on NYSE, NASDAQ, or Amex or significant to a lesser extent for firms listed in the U.S. over-the-counter markets. A possible explanation for such a difference is that B-share organizations and organizations listed on NYSE, NASDAQ, Amex, or over-the-counter markets tend to have higher accounting quality due to relatively demanding requirements [40]. As a result, B-share organizations and organizations listed on NYSE, NASDAQ, or Amex may have fewer errors in XBRL implementation, less uncertainty in reporting quality, and thus experience no increase to the cost of capital. Such a finding confirms the suggestion of Li and Pinsker [45] that uncertainty associated with XBRL adoption is especially salient for organizations with weak public information.

**Table 3**  
Model testing results.

Panel A: Model (1) for H1 where r is the dependent variable				
Adjusted R <sup>2</sup> = 0.17	Coeff.	Standard error	t-Statistic	Two-tailed p-value
Intercept	0.230	0.054	4.26	<0.001
Post	0.027	0.005	5.53	<0.001
OTC	-0.004	0.008	-0.57	0.571
EXCH	0.035	0.012	2.94	0.003
SIZE	-0.009	0.002	-3.69	<0.001
RETVAR	0.042	0.037	1.14	0.255
LEV	0.079	0.012	6.59	<0.001
MB	-5.807	1.098	-5.29	<0.001
Industry	0.002	0.002	0.96	0.339
Firm	-0.000	0.000	-2.23	0.026
Panel B: Model (2) for H2 where LNSPREAD is the dependent variable				
Adjusted R <sup>2</sup> = 0.59	Coeff.	Standard Error	t-statistic	Two-tailed p-value
Intercept	-3.067	0.158	-19.39	<0.001
Post	0.181	0.014	12.80	<0.001
OTC	-0.023	0.023	-1.00	0.316
EXCH	0.038	0.035	1.07	0.283
SIZE	-0.036	0.007	-5.09	<0.001
RETVAR	1.910	0.108	17.66	<0.001
LEV	0.195	0.035	5.56	<0.001
MB	15.073	3.212	4.69	<0.001
Industry	0.013	0.005	2.72	0.007
Firm	-0.000	0.000	-0.17	0.863

More established organizations listed in major exchanges are less concerned with the increase in the cost of capital resulting from the XBRL mandate. It also confirms the importance of contingent factors in realization of IT's business value [29,74,80]. Another possible explanation may be that there is a selection difference because more cost-efficient firms can pass the more stringent listing requirements for B-shares and for organizations listed on NYSE, NASDAQ, Amex, or over-the-counter markets.

Besides, the results from cross-sectional portfolio tests reveal consistent positive coefficients for “Post” across firms with other different attributes in terms of leverage, market-to-book ratio, and size with the exception of return variability. In terms of the cost of capital, the coefficient for “Post”, 0.025, for organizations with high return variation is not significant due to higher standard error. One possible explanation is that investors rely less on financial reporting for such firms due to the negative relationship between information quality and return volatility [13] such that XBRL formatted financial reporting has limited impact on these organizations' cost of capital.

## 5. Conclusions

By separating content from format, XBRL is expected to benefit all members of the financial information supply chain with improved efficiency and reliability of business information and to reduce the cost of capital. This study examines the impact of initial mandatory adoption of a new online business reporting technology on the cost of capital and transaction costs with empirical data of Chinese organizations between 2001 and 2006. As the transaction cost theory predicts, the

**Table 4**  
Robust tests by removing transition period or one period data.

	H1: r Non-transition	H2: LNSPREAD Non-transition	H1: r Both periods	H2: LNSPREAD Both periods
Intercept	0.215**	-2.948**	0.316**	-3.111**
Post	0.037**	0.195**	0.030**	0.165**
OTC	-0.004	-0.034	-0.003	-0.027
EXCH	0.028	0.025	0.042**	0.028
SIZE	-0.009**	-0.039**	-0.013**	-0.031**
RETVAR	0.027	1.598**	-0.015	1.690**
LEV	0.090**	0.185**	0.079**	0.193**
MB	-5.737**	15.201**	-3.892*	9.733*
Industry	0.003	0.014*	0.001	0.007
Firm	-0.000*	-0.000	-0.000	-0.000
N	431	431	258	258
Adjusted R <sup>2</sup>	0.22	.58	0.21	0.54

\*\* Indicates significance at  $p < 0.01$ .

\* Indicates significance at  $p < 0.05$ .

**Table 5**  
"Post" coeff. comparison among different firm attributes from subsample regression tests.

	H1: r		H2: LNSPREAD	
	Coeff.	Standard error	Coeff.	Standard error
<i>Panel A: Different listing attributes</i>				
EXCH = 0	0.028**	0.005	0.177**	0.015
EXCH = 1	−0.003	0.023	0.280**	0.052
OTC = 0	0.027**	0.005	0.180**	0.015
OTC = 1	0.022*	0.009	0.207**	0.036
A-share = 0	0.060	0.034	−0.067	0.057
A-share = 1	0.026**	0.005	0.170**	0.014
<i>Panel B: Other different firm attributes</i>				
LEVH = 0 or low leverage	0.027**	0.005	0.176**	0.021
LEVH = 1 or high leverage	0.026**	0.009	0.201**	0.021
MBH = 0 or low market-to-book	0.029**	0.006	0.159**	0.016
MBH = 1 or high market-to-book	0.022**	0.007	0.221**	0.028
RETVARH = 0 or low variation	0.025**	0.005	0.189**	0.017
RETVARH = 1 or high variation	0.025	0.019	0.095*	0.039
SIZEH = 0 or small size	0.030**	0.006	0.184**	0.019
SIZEH = 1 or large size	0.022**	0.008	0.145**	0.021

\*\* Indicates significance at  $p < 0.01$ .

\* Indicates significance at  $p < 0.05$ .

uncertainty related to the unproven technology, such as difficulty of use and information errors, increases transaction costs and the cost of capital during the early adoption period among organizations with limited public information. Despite the expected benefits from improved efficiency and accuracy from XBRL, the value realization of XBRL adoption can be hindered by uncertainty related to the development and implementation of the technology. Such a finding calls for technology implementation refinement and quality assurance. The finding implies that value realization of new information technology takes time due to necessary adjustments and fine-tuning. More established organizations listed in major exchanges are less concerned with the increase in the cost of capital resulting from the XBRL mandate. Such a finding implies that strong assurance requirements may play an important role in realizing the value of XBRL adoption. It also confirms the importance of contingent factors in realization of IT's business value.

Our findings have implications for standard developers, regulators, and taxonomy users. Such findings have policy implications. XBRL taxonomy should be improved to minimize the need for taxonomy extensions, so as to improve data comparability and improve the quality of data analysis and usage. Regulators should implement mandatory XBRL adoption with stricter policies on quality assurance to ensure the quality and reliability of information reported in XBRL taxonomy. Taxonomy users should be educated on common causes for errors in XBRL implementation to avoid the improper use of the taxonomy and to achieve the efficiency of the financial data supply chain for better value realization.

The following caveats limit generalization from the research findings. First, PEG ratio is the proxy for the cost of capital due to its attested effectiveness in comparison to other methods of estimation. Findings with modified PEG ratio and Gode and Mohanram proxy for the cost of capital attest the robustness of findings based on the PEG ratio. Future studies may investigate if the conclusions are still valid and robust when alternative proxies for the cost of capital or transaction costs are used. Second, data are from one particular country and thus limit the generalizability of the research findings. Former studies (e.g. [42]) show that the quality of business reporting is sensitive to the quality of legal enforcement. The exceptional case for organizations listed on NYSE, NASDAQ, or Amex echoes such an assertion and partially explains our different findings in comparison with research findings based on the U.S. data [44]. The cost of capital and transaction costs of organizations controlled by a developing economy may not fully represent

organizations in a free market economy. Future studies may investigate the impact of XBRL adoption with empirical data from other nations with different levels of legal enforcement or economic systems to see if such an impact is indeed sensitive to institutional environments of different nations. Third, XBRL is being continuously developed and improved. Future studies may investigate any change in XBRL adoption's impact on the cost of capital with more recent data. This study uses variables previously found to affect the cost of capital as control variables. Future discovery of additional variables influencing the cost of capital may contribute to stronger explanatory power of the research model. Our contributions are limited to the understanding of XBRL impact on mandatory adopters in China. It will be interesting to find how XBRL affected the voluntary adopters at the initial trial period in China. XBRL facilitates easier exchange of information in mergers and acquisitions due to the independence of its application. It will be valuable to investigate whether XBRL adopted and non-adopted firms performed differently after mergers and acquisitions. Besides, more study is necessary to uncover the causes of uncertainty in XBRL adoption and discover ways to fine-tune the technology toward accuracy and ease of use.

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## Appendix A. Variable definitions

Variable	Definition
A-share = 0	The subsample of firms whose stocks are B-shares.
A-share = 1	The subsample of firms whose stocks are A-shares.
EXCH	An indicator that equals to 1 if a firm is on the NYSE, NASDAQ, or Amex.
EXCH = 0	The subsample of firms other than those listed on the NYSE, NASDAQ, or Amex.
EXCH = 1	The subsample of firms that are listed on the NYSE, NASDAQ, or Amex.
Firm	An indicator for the firm whose data are collected from.
Industry	An indicator for the industry membership of a firm.
LEV	The financial leverage based on total liabilities divided by total assets at year-end [43].
LEVH = 0	The subsample of firms whose LEV or financial leverages are no more than average LEV.
LEVH = 1	The subsample of firms whose LEV or financial leverages are above average LEV.
LNSPREAD	Natural log of bid-ask spread (Lang et al., 2012).
MBH = 0	The subsample of firms whose MB or market-to-book ratios are no more than average MB
MBH = 1	The subsample of firms whose MB or market-to-book ratios are above average MB
N	firm years
OTC	An indicator that equals to 1 if a firm is in the U.S. over-the-counter markets.
OTC = 0	The subsample of firms other than those listed in the U.S. over-the-counter markets.
OTC = 1	The subsample of firms that are in the U.S. over-the-counter markets.
Post	An indicator that equals to 1 for the period since the XBRL adoption mandate and 0 otherwise.
r	The cost of capital determined with the Price/Earnings to Growth ratio (PEG ratio) [24].
RETVAR	The return variability as the annual standard deviation of monthly stock returns at year-end [43].
RETVAR = 0	The subsample of firms whose RETVAR or return variability is no more than average LEV.
RETVAR = 1	The subsample of firms whose RETVAR or return variability is above average RETVAR.
SIZE	The firm size measured as the natural logarithm of total assets at year-end [43].
SIZEH = 0	The subsample of firms whose SIZE is no more than average SIZE.
SIZEH = 1	The subsample of firms whose SIZE is above average SIZE.

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